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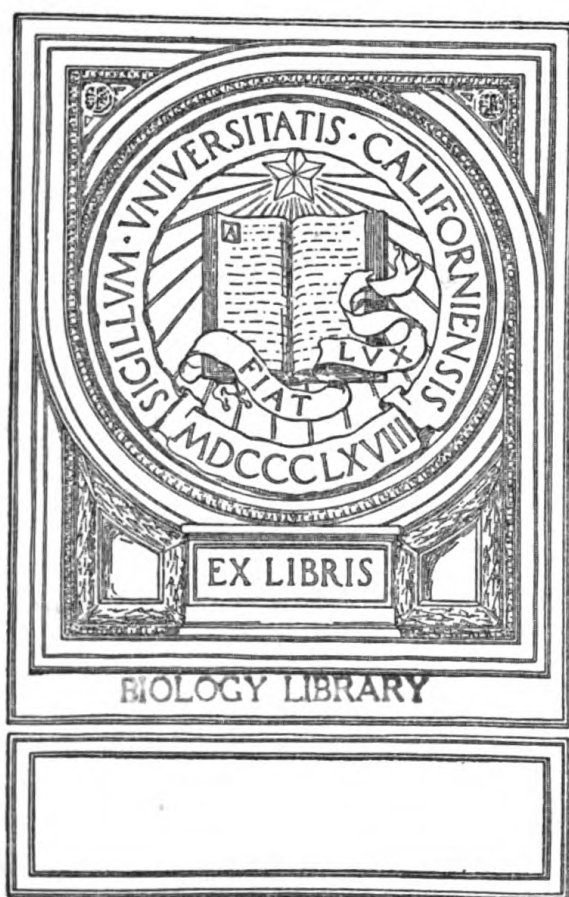http://hdl.handle.net/2027/uc1.b2951834

United States
Naval
Medical Bulletin

UNITED STATES
NAVAL
MEDICAL BULLETIN

FOR THE INFORMATION OF
THE MEDICAL DEPARTMENT OF THE NAVY

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DIVISION OF PUBLICATIONS
THE BUREAU OF MEDICINE AND SURGERY

THE MISSION OF THE MEDICAL DEPARTMENT OF THE NAVY

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TO KEEP AS MANY MEN AT AS MANY GUNS AS
MANY DAYS AS POSSIBLE

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NAVY DEPARTMENT,
Washington, March 20, 1907,.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

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PREFACE

THE UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of appreciation to authors of papers of outstanding merit.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

<div align="right">

ROSS T. McINTIRE,
Surgeon General, United States Navy.

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VII

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The greatest accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible for the editor to understand or verify references, quotations, etc. The frequency of gross errors in orthography in many contributions is conclusive evidence that authors often fail to read over their manuscripts after they have been typewritten.

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LOUIS H. RODDIS, *Editor,*
Captain, Medical Corps, United States Navy.
HILTON W. ROSE, *Assistant Editor,*
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United States Naval Reserve.

VIII

SPECIAL ARTICLES

BLOOD SUBSTITUTES
THEIR DEVELOPMENT AND USE IN THE ARMED SERVICES

By Lieutenant Commander L. R. Newhouser, Medical Corps, United States Navy, and Captain
D. B. Kendrick, Medical Corps, United States Army

The recognition of the value of human blood plasma and serum as therapeutic agents for the treatment of surgical emergencies is one of the outstanding advances of medical science in recent years.

The experience gained in recent European campaigns focuses attention upon the need for a therapeutic agent that can be used effectively in the emergency treatment of traumatic shock, burns, and hemorrhage resulting from modern military operations. Reports of qualified observers in Great Britain (1) clearly indicate the need for a simple, readily available, and efficient method of treating shock. Their experience has shown that in multiple injuries resulting from shrapnel, splinters, and falling masonry, caused by high explosive bombs, that traumatic shock is a common complication and the one that presents the greatest challenge to successful treatment.

The changes in physiology which occur in traumatic shock result primarily from the loss of circulating blood volume. The reduction in volume initiates a vicious chain of events: A compensatory vasoconstriction, hemoconcentration, decreased venous return and cardiac output, anoxia, increased capillary permeability, a generalized loss of fluid into the extravascular spaces and a fall in blood pressure. It has been demonstrated experimentally and clinically that the decrease in blood volume results initially from a loss of plasma. The red blood cells are retained in the vascular bed until the terminal stage of shock when the capillary endothelium is severely damaged by prolonged anoxia. Therefore the aim in the treatment of secondary shock, regardless of etiology, is the restoration of circulating blood volume. This loss may be replaced promptly by the administration of plasma or serum. The replacement of fluid elevates the blood pressure and provides a vehicle for the circulation of red blood cells which is so necessary to overcome the tissue anoxia.

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HISTORICAL RÉSUMÉ

Probably the earliest plea for the use of human blood plasma as a substitute for whole blood was made by Capt. Gordon R. Ward, R. A. M. C., in a letter, dated March 3, 1918, addressed to the editor of the British Medical Journal (2). He pointed out that the chief difficulty in the transfusion of whole blood was that the recipient's plasma might hemolize the corpuscles of the donor. He made the observation that death from hemorrhage was not due to lack of red blood cells but due to the loss of fluid. He suggested that the depleted fluid could be replaced by the administration of citrated plasma, which could be prepared easily and injected safely.

Rous and Wilson (3), in 1918, successfully treated hemorrhage produced experimentally in animals by the injection of plasma. They postulated that the replacement of red blood cells is not essential because, even in severe hemorrhage, a sufficient number of red blood cells remain to support life. They demonstrated that the restoration of blood volume with plasma is the most important factor in returning the blood pressure to a normal level.

In the treatment of surgical shock, produced experimentally in dogs, Mann (4), noted that the injection of normal serum produced results which were as good or better than any other method at his disposal. He asserted prophetically that homologous serum might be of value for the treatment of shock under conditions where whole blood could not be obtained.

Based on work done at the United States Naval Medical School, Washington, D. C., Hartman (5), in 1918, reported the use of convalescent plasma intravenously, without regard to group or compatibility, in the treatment of severe epidemic influenza.

Strumia et al. (6), in 1927, began using human serum intravenously for the treatment of severe infections. Later in 1927 they started using plasma because of its simplicity of preparation and its greater yield.

In 1936, Elliott (7) suggested the use of untyped serum or plasma for the treatment of traumatic shock. He reasoned that the restoration of blood volume is more important than the replacement of red blood cells as the maintenance of osmotic pressure is a function of plasma proteins.

Fantus (8), in 1937, advocated the use of normal human serum because of its therapeutic and natural immunizing properties. The use of serum was also advocated by him for the treatment of shock and burns because of hemoconcentration commonly seen in these injuries.

Encouraging results on the use of preserved plasma in the treatment of experimental and clinical shock were reported in 1938 by Mahoney

(9). Elkinton (10) and McClure (11), in 1939, working separately, reported good results from the use of plasma in burn cases.

Tatum, Elliott, and Nesset (12), in 1939, suggested a technic for the preparation of plasma by a closed system to prevent contamination. They recommended plasma as an ideal substitute for whole blood in the emergency treatment of shock and hemorrhage associated with war wounds.

In 1940, Strumia et al. (6) advocated untyped citrated blood plasma for the treatment of burns and shock. The same year Best and Solandt (13) reported encouraging evidence in favor of plasma and serum in the prevention of traumatic shock.

In 1941, Kendrick (14) proposed the use of plasma for the prevention and treatment of shock in the combat zone. In the same year Kekwick et al. (1), based on their experience in the treatment of shock and hemorrhage in air raid casualties, concluded that plasma is effective in restoring blood volume in injuries of this type.

DEVELOPMENT OF BLOOD PLASMA IN THE ARMY AND NAVY

A revival of interest in blood substitutes parallels the beginning of active hostilities in Europe. Reports on the use of plasma and serum as effective agents for the treatment of war casualties began to appear in the literature as early as 1940. In anticipation of the need for available blood substitutes in the armed services, members of the staffs (the authors) of the Army and Navy Medical Centers started almost simultaneously in March 1940 investigating means for blood procurement and methods of preparing human plasma and serum. During the following 10 months efforts were directed toward the experimental and clinical preparation and use of liquid and dry plasma in order to evaluate the efficiency of various methods advocated for preparing dried plasma. Equipment was set up and the principles of drying as advocated by Shackell (15) ; Edwards, Kay, and Davies (16) ; Hartman (17) ; and Harper, Essex, and Osterberg (18) were given experimental trial. A special apparatus of our own design, modeled after the equipment used for drying milk, was constructed and tested.[1]

This procedure consisted of spraying plasma under pressure through a fine nozzle into a large chamber containing dry air warmed to 40 degrees centigrade. This method produced a product of excellent solubility but the method was abandoned because of the difficulty of maintaining sterility and preventing the loss of plasma which escaped in the form of a fine powder.

In addition to these laboratory investigations, the plasma division of the following institutions were inspected in order to further our knowledge of the preparation of blood substitutes: Bryn Mawr Hos-

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[1] Apparatus constructed by J. F. Adams, Ph. M. 2 c., U. S. N.

pital; Johns Hopkins Hospital; Henry Ford Hospital; Rowan Memorial Hospital, Salisbury, N. C.; Gallinger Hospital, Washington, D. C.; Presbyterian Hospital, New York; Memorial Hospital, New York; Indiana University Hospitals; Children's Hospital, Philadelphia; Sharpe and Dohme Laboratories; Baxter Laboratories and Stokes Machine Co. The experience gained by visiting these hospitals and laboratories proved of inestimable value in determining satisfactory methods and technic for the preparation of plasma and serum.

It became apparent from our studies that the preparation of liquid plasma in a "closed system" was a safe procedure when carried out under controlled conditions. Equipment was obtained and the preparation of liquid plasma for clinical use was undertaken in September 1940. Voluntary donors were enrolled by the local chapter of the American Red Cross for this program. By December 1940, it had been clearly demonstrated that liquid plasma could be economically prepared and safely administered locally or shipped to distant stations. On several occasions liquid plasma was transported without refrigeration from Washington, D. C., to California [2] and to Cuba,[2] and there used successfully in the treatment of traumatic shock. During this period 75 bottles of plasma were prepared of which 61 were used without an unfavorable reaction occurring.

During the period from August 1940 to August 1941, 1,510 donors have been bled at the Army-Navy Blood Donor Center. From these donations 316,400 cc. of liquid plasma have been processed. Eight hundred and twenty-five bottles of plasma have been prepared, of which 615 have been issued for use at the Walter Reed Hospital and all Naval Hospitals within the continental limits of the United States. Reports have been received on 508 administrations.

Plasma prepared at this Center has been collected and processed in vacuum bottles, insuring a "closed system" throughout. Practically all of the plasma has been prepared by centrifugation. In order to reduce the agglutinin titre, the plasma has been pooled in 2,000 cc. lots. Aerobic and anaerobic cultures have been taken on every pool and a bacteriostatic agent added. One cc. of 1 percent sodium ethylmercurithiosalicylate (merthiolate) per 100 cc. of plasma has been used, giving a final dilution of 1:10,000. Cultures inoculated into Brewer's media have been observed routinely for a period of 10 days before filling the final container. Secondary cultures and toxicity tests have been made at the time the final containers are filled and observed for an additional 10 days before the plasma is released for use. Thus far four contaminations have occurred, two of which were traced to improperly sterilized donor sets and the other two were believed to be due to errors in technic. These four contaminations occurred while technicians were undergoing basic training in the processing of plasma. In the series of 508 bottles of plasma that have been administered to patients in Army and Navy hospitals there have resulted five mild reactions

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[2] Plasma used by Capts. A. H. Dearing and M. D. Willcutts (Medical Corps), United States Navy.

which may be attributable to plasma. These reactions have consisted of chills and an approximately 2-degree rise in temperature. There have also occurred two generalized and one localized urticarial reactions.

At the present time liquid plasma is being frozen and stored at minus 20° F. The plasma is thawed at 98° F. just prior to shipment or when used locally. It is well established that plasma in the frozen state retains nearly all of its normal constituents, while dried plasma loses a fairly large percentage of its complement and prothrombin as a result of the process of desiccation. Rapid thawing of plasma at body temperature is not injurious to the labile substances in plasma. Plasma from this laboratory has been thawed and frozen eight times and administered clinically without untoward reactions (19).

THE NATIONAL PROGRAM FOR THE COLLECTION OF BLOOD AND THE PREPARATION OF PLASMA FOR THE ARMY AND NAVY

In the spring of 1940, as a result of the reverses suffered by the Allies at the hands of the Axis powers, it became apparent that we were facing a national emergency. In May of that year a limited national emergency was proclaimed by the President. The Surgeons General of the Army and Navy, realizing the gravity of the situation, requested the aid of the National Research Council to assist in solving the many medical problems arising from the rapid expansion of the armed services. As a result of this request, Dr. Lewis Weed, chairman of the Division of Medical Sciences, National Research Council, Washington, D. C., appointed a number of committees to serve during the national emergency in an advisory capacity.

Due to the prevalence of shock resulting from war injuries, among the first committees appointed were those for the studies of shock, blood transfusions, and blood substitutes. This paper is concerned only with the problems that confronted the Subcommittee on Blood Substitutes as to the use of blood substitutes in the Army and Navy. The authors, while carrying out investigations of their own, also served, as representatives of the Army and Navy, to aid in bringing to the attention of the committee the urgent needs of the services for agents which could be made readily available for emergency use in the treatment of shock resulting from military engagements.

Various research problems were assigned to members of the Subcommittee on Blood Substitutes. Efforts were directed toward determining the practicability of transporting and administering whole blood; the preparation of liquid and dried plasma and serum; and the development of suitable equipment for the collection of blood and the dispensing of blood substitutes in the field. The practicability of transporting blood, adequately but simply refrigerated, over great distances, was well demonstrated by the work of DeGowin and Hardin

(20). The experimental and clinical use of frozen and dried plasma, carried out by Strumia and McGraw (21), established the efficacy and safety of these types of preparation.

The first assignment given Strumia, as a member of the Subcommittee on Blood Substitutes was to study methods of preparing dried plasma. After considerable research on the various methods of drying plasma he concluded that normal liquid plasma should be shell-frozen and desiccated from the frozen state under high vacuum at low temperature. Plasma dried in this manner retains most of its labile constituents, such as prothrombin, complement, and fibrinogen. When properly packaged it can be safely stored for a period of at least 5 years. This product was given ample clinical trial under the supervision of members of the Blood Substitutes Subcommittee and representatives of the Army and Navy. Seventy-two packages of dried plasma prepared by Strumia were administered in hospitals of the Army and Navy under supervision of the authors and the results were uniformly satisfactory. Based on the reports obtained from the use of this material and because of its long period of preservation, it was considered to be the blood substitute of choice for use by the armed services for the treatment of shock and other allied conditions.

The development of an adequate and satisfactory blood substitute was a distinct advance in transfusion methods for the treatment of surgical emergencies encountered in sea, land, and aerial warfare. However, a satisfactory method of packaging dried plasma, so as to make it available for casualties produced during military engagements remained to be worked out.

As a result of the experimental work of the Subcommittee on Blood Substitutes, it was recommended to the Surgeons General of the Army and Navy that dried plasma, prepared according to the principles outlined by Strumia and McGraw (21), be accepted for use in the armed services. On the basis of this recommendation a contract was made with a commercial biological firm for the manufacture of 15,000 packages of dried plasma, complete with distilled water and intravenous equipment.

When this biological firm began supplying packages of dried plasma, prepared under contract, to the Army and Navy, it was deemed advisable to have the material tested clinically for evidences of defects in the material and package. The testing of these packages of dried plasma was assigned to the authors. Laboratory and clinical tests showed that the dried plasma was entirely satisfactory; however, the method of packaging was found to be unsatisfactory for military use.

Upon the recommendation of the authors a number of changes were made in the package which made it a satisfactory unit for use in large hospitals. But due to the excessive size, undue weight, and vulnerability to breakage, it was concluded that this package was not suitable for military use in the field or aboard ship. It was therefore necessary to devise a method of packaging dried plasma which would eliminate the above-mentioned disadvantages.

FIGURE 1.—CONTENTS OF STANDARD ARMY-NAVY PACKAGE OF DRIED NORMAL
HUMAN PLASMA.

FIGURE 2.—COMPLETED PACKAGE SHOWING LISTING OF CONTENTS.

FIGURE 3.—COMPLETED PACKAGE SHOWING ORIGIN OF BLOOD PLASMA.

There were two methods of packaging which were considered, the flamed-sealed bottle and the rubber-stoppered bottle protected by packing it in a metal can under vacuum. It is well established that a flame-sealed glass container is the ideal container for the storage of dried biologicals; however, a bottle of this kind offers certain disadvantages which become apparent on long storage or when used under combat conditions. The rubber tubing on the intravenous accessories will deteriorate markedly on long storage and will therefore be found unsatisfactory for use before the end of the storage period. The flame-sealed bottle has a long glass neck which may be readily broken in shipment and also this neck necessitates an unnecessarily large package.

The rubber-stoppered glass bottle also possesses certain disadvantages. It is essential that dried plasma packaged in this type of container be stored under vacuum. If left open, the rubber stopper, due to its porosity, tends to permit the leakage of air and moisture on long storage. This defect is easily remedied by placing the bottle of dried plasma in a vacuum-sealed metal can. This method of packaging dried plasma offers the advantage that the rubber tubing on the intravenous equipment can be packaged under nitrogen in the metal can containing the bottle of distilled water used for restoring the dried plasma (figure 1). This method of packaging dried plasma offers an additional advantage in that the entire unit occupies less space than the flame-sealed bottles. This advantage is readily appreciated when units of plasma are to be stored aboard combatant ships where space is at a premium.

On the basis of our experience with the flame-sealed containers and the use of the rubber-stoppered plasma package as originally developed by Strumia, it was proposed by the authors that a standard package for dried plasma applicable for field use and aboard ship be developed for the Army and Navy. This proposal was accepted and the Subcommittee on Blood Substitutes of the National Research Council assigned us the task of developing and writing specifications for a standard package of dried plasma for use in the armed services.

A brief description of the recommended package follows:

The completed package (fig. 1) consists of two 400 cc. bottles stoppered with vaccine-type rubber stoppers; intravenous equipment in sealed metal cans and packaged in a tape-sealed waterproofed fiberboard box. One bottle (fig. 1) contains the dried plasma obtained from 300 cc. of citrated plasma and is sealed under 29 inches of vacuum. This bottle is fitted with a cloth tape to be used for suspending it in the inverted position while the plasma is being injected. The other bottle contains 300 cc. of sterile pyrogen-free distilled water sealed without vacuum. The intravenous equipment consists of an airway assembly and an intravenous set (fig. 4). The airway assembly consists of 9 inches of rubber tubing with a needle attached on it for insertion into the rubber stopper and a cotton filter on the other end. The intravenous set is made up of 48

inches of rubber tubing which contains a glass cloth filter for filtering the plasma as it is administered. At the end of the tube is an intravenous needle and at the other, a short needle which connects the set to the plasma bottle. The bottle containing the distilled water is sealed in one metal can which is filled with dry nitrogen. The bottle containing the dried plasma along with the intravenous needle, clamp, and double-ended needle used for adding the distilled water to the plasma is placed in the second can which is sealed under 25 inches of vacuum. The instructions for the preparation and use of this material are lithographed on the can containing the plasma bottle (fig. 5). Both cans together with a questionnaire for recording data on the use of this unit are packaged in a tape-sealed waterproofed fiberboard box. As the cans

FIGURE 2.—Plasma set assembled ready for use.
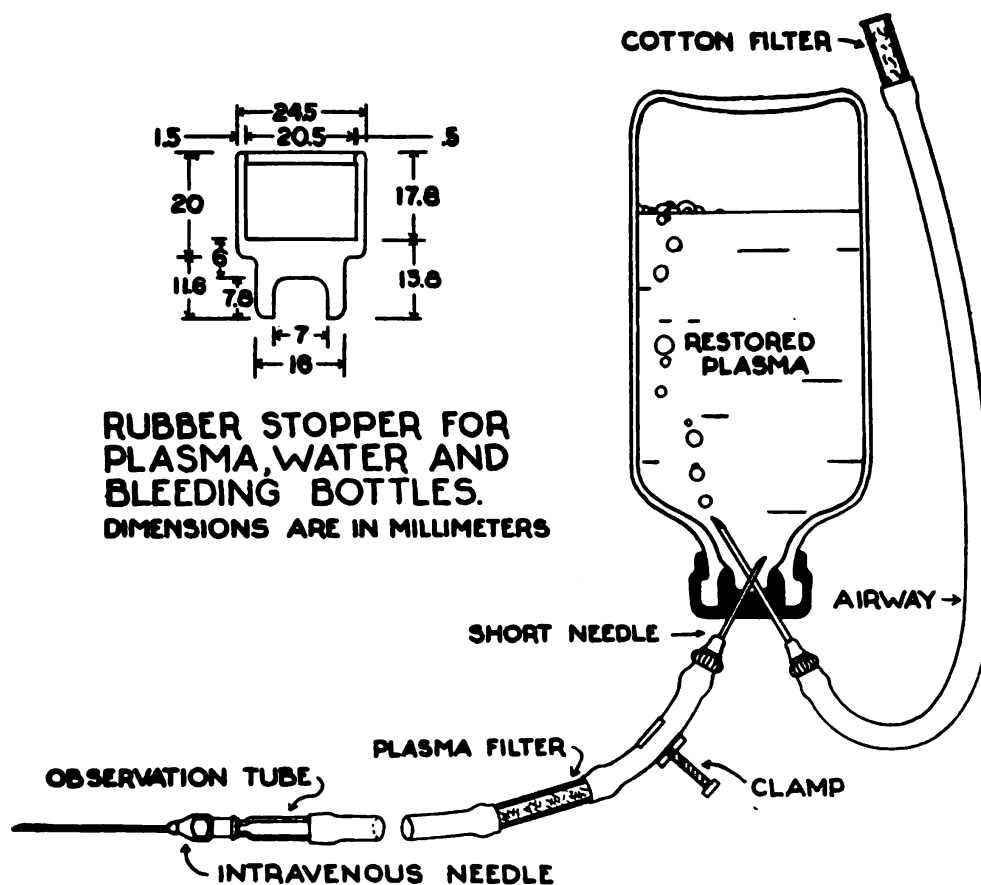
fit very snugly in the box, a string is placed around the cans to facilitate the removal of them (fig. 6). The finished package (fig. 2 and fig. 3) has on one end, a label of the biological firm processing the plasma and on the other end a Red Cross label showing that the blood from which this plasma was made was furnished by volunteer Red Cross donors.

The plasma is made ready for use by inserting the double ended needle in the stopper of the bottle containing the distilled water. This bottle is then inverted and the other end of the needle is plunged into the stopper of the dried plasma bottle. The vacuum in this bottle causes the water to flow in and the plasma goes into solution within 2 minutes. The airway and intravenous set are then connected (fig. 4) ad the plasma is ready to administer.

The specifications for this package with the detailed illustrations embodying the plasma package, were submitted to the Blood Substitutes Subcommittee of the National Research Council and the Surgeons General of the Army and Navy for approval. After approval these

STANDARD ARMY AND NAVY PACKAGE OF NORMAL HUMAN PLASMA, DRIED

INSTRUCTIONS FOR USE

1. Open metal cans with attached keys.
2. Remove plasma and water bottles. Cleanse stoppers with alcohol.
3. Remove cellophane from double-ended needle and remove glass tube from one end of needle.
4. With water bottle in upright position insert uncovered end of double-ended needle through stopper into the water bottle.
5. Remove cellophane and glass tube covering airway needle and insert needle of airway assembly through rubber stopper into the water bottle.
6. Elevate free end of airway assembly to prevent water from wetting cotton filter in airway. CAUTION: If cotton in airway filter becomes wet—remove it.
7. Remove glass tube from other end of double-ended needle. Invert water bottle and insert needle through stopper into plasma bottle. (See diagram A.)
8. Allow water to be drawn into plasma bottle. CAUTION: If vacuum in plasma bottle is lost, apply pressure in water bottle by forcing air into airway tube. If this method fails, remove stoppers and pour water into plasma bottle. Replace stopper on plasma bottle and continue immediately.
9. After water is added, double-ended needle is removed from plasma bottle.
10. Shake plasma bottle until plasma is completely dissolved.
11. Apply metal clamp to the 4-inch piece of rubber tubing on the intravenous set and close it.
12. Remove coverings from short needle attached to intravenous set and insert through stopper of plasma bottle.
13. Withdraw needle of airway assembly from water bottle and insert through stopper into plasma bottle.
14. Invert plasma bottle and suspend it for administration. (See diagram B.)
15. Fix glass end of the airway assembly with the suspension tape above the inverted plasma bottle.
16. Remove cellophane from observation tube and intravenous needle.
17. Attach intravenous needle to tube and remove glass tube from needle.
18. Loosen metal clamp and allow plasma to fill rubber tubing. When tube is filled, and free of air bubbles, tighten metal clamp.
19. Insert needle in vein and regulate flow with screw clamp. If patient is to receive additional plasma, restore second bottle as outlined. Close regulating clamp as soon as first bottle is empty, but before air enters tube. Pull out needles from first bottle and insert in second bottle. Elevate end of airway and fix it in place with the suspension tape.
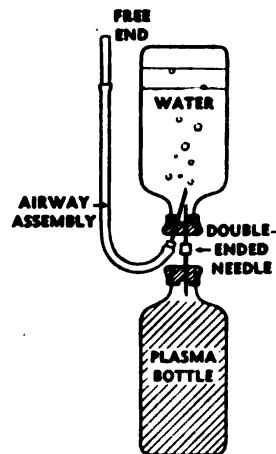
DIAGRAM A
RESTORATION OF THE DRIED PLASMA
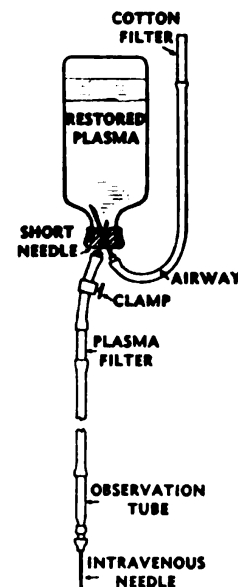
DIAGRAM B

FIGURE 3

specifications were adopted as the standard Army and Navy package for dried plasma. It is felt that this package provides an efficient method for administering plasma in the field under combat conditions and aboard ships during naval engagements. By using this pack-

age it is possible to treat shock, hemorrhage, and burns resulting from war injuries much earlier than was formerly possible. It is contemplated that the restoration of lost blood volume can be started as far forward as the Collecting Station. The administration of fluids early makes it possible to prevent the development of shock rather than having to treat shock after it develops.

Having decided upon the blood substitute to be used and the standard package with which to dispense it, it was then necessary to establish a program for the collection of blood and the preparation of blood plasma on a nation-wide scale in order to have a sufficient quantity of plasma in case of a full national emergency. Acting upon recommendations of the Blood Substitutes Subcommittee and with the help of the American Red Cross, bleeding centers have been established in various parts of the country for the collection of blood from volunteer donors.

In order to supply an adequate amount of dried plasma for the armed services, it was necessary to call upon a number of licensed biological firms to process dried plasma. The authors were directed to inspect the biological firms that were interested in participating in this program. An inspection of these commercial firms revealed that seven of them were in a position to prepare dried plasma.

Under the supervision of the Subcommittee on Blood Procurement of the Committee on Blood Transfusions, the American Red Cross was requested to install bleeding centers in densely populated areas in close proximity to the processing centers. This program is well under way and contracts have been made with biological firms to furnish 200,000 packages of dried plasma to the Army and Navy. A testing committee, consisting of a representative of the National Institute of Health (Dr. Milton Veldee) and two representatives of the Army and Navy (the authors), appointed by the National Research Council, is testing and attempting to evaluate the efficacy of the various blood substitutes. In addition, an effort is being made to develop equipment for administering these materials. All dried plasma furnished by the biological firms participating in the national program will be given the necessary clinical tests prior to its acceptance by the Army and Navy.

In an effort to provide a smaller package to be used by the armed services for administering plasma, it was proposed that concentrated plasma be tried. By using 4 times concentrated human plasma, as suggested by Hill and Pfeiffer (22), it would be possible to reduce the size of the package by 10 times. As a result of this proposal, the Blood Substitutes Subcommittee recommended that the authors test out 4 times concentrated plasma clinically in traumatic
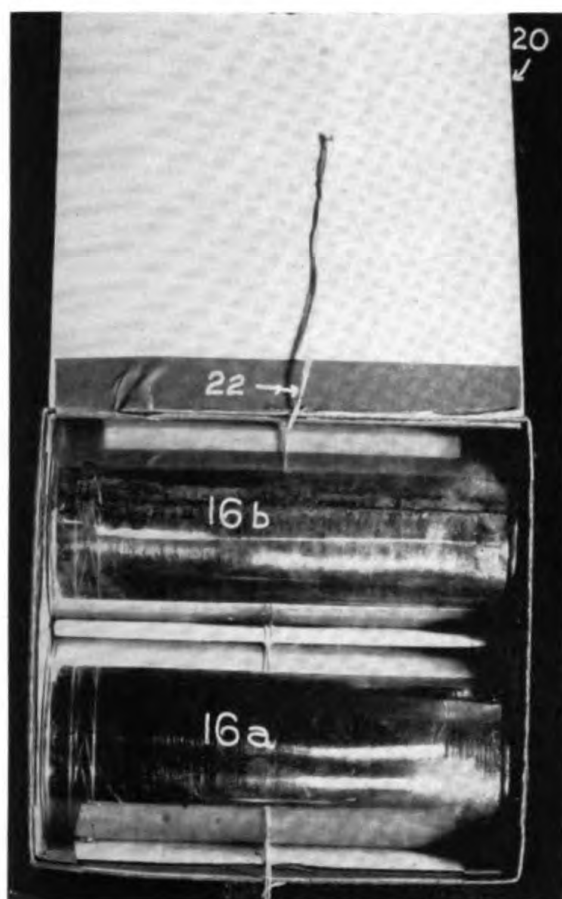
FIGURE 6.—SHOWING CORD FOR REMOVAL OF METAL CANS.

PLATE 4
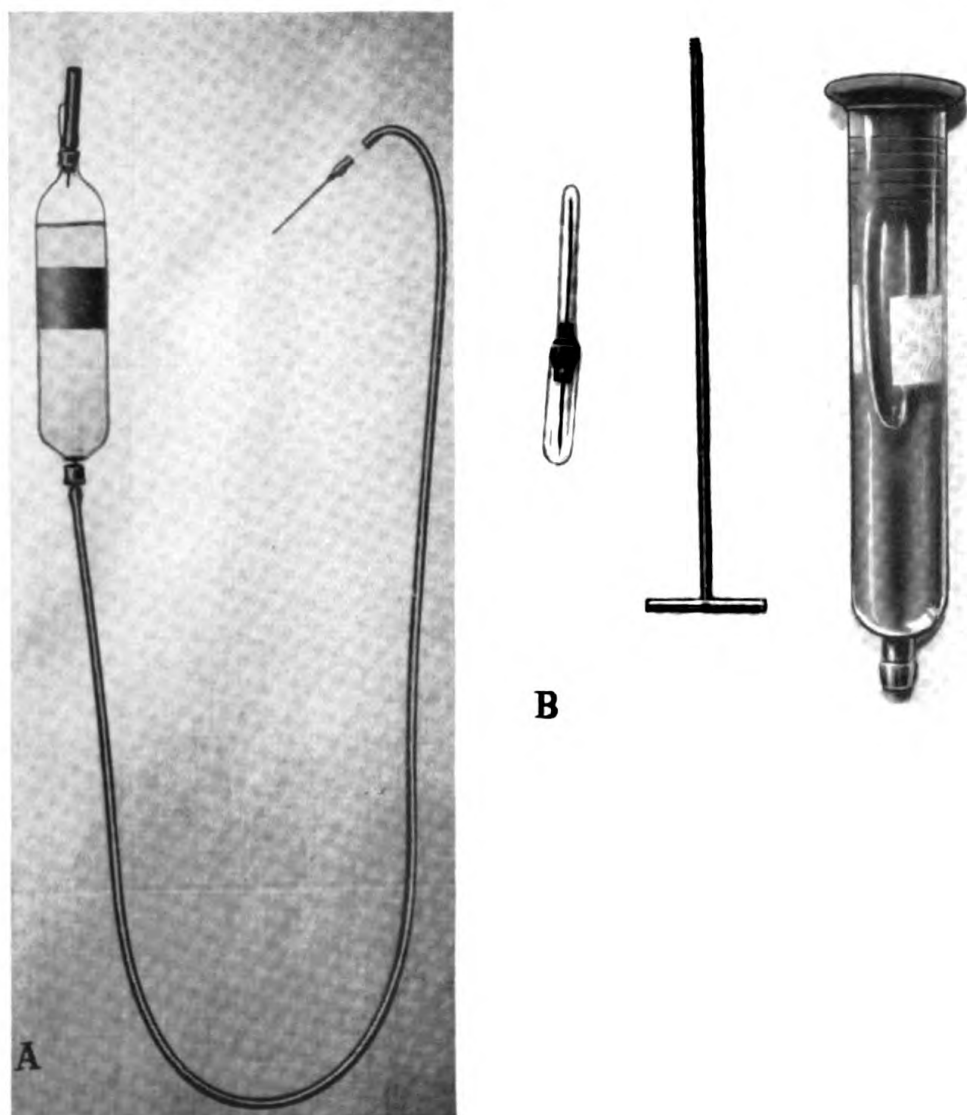
FIGURE 7.—PROPOSED EQUIPMENT FOR ADMINISTERING ALBUMIN.

and surgical shock. Twenty-one packages of 4 times concentrated plasma were administered to patients at the Army and Navy Medical Centers. The conclusions based on this study were that 4 times concentrated plasma was not as effective as normal plasma in treating low blood pressure associated with surgical shock. In several of these patients there was a definite fall in blood pressure following the use of this material. In most of the cases it was necessary to resort to normal plasma or whole blood or both to accomplish the effect that 4 times concentrated plasma had failed to do. As a result of this study and the experience of other members of the committee on the use of concentrated plasma, the Blood Substitutes Subcommittee recommended that the Army and Navy use normal plasma and not concentrated plasma in the treatment of shock and hemorrhage.

At the present time, the Subcommittee on Blood Substitutes is continuing its work investigating blood substitutes in an effort to find substitutes more readily available and equally as effective as human blood plasma. Human albumin, prepared by Cohn (23), has been given a limited clinical trial and the results thus far are encouraging. Albumin makes up 65 percent of the proteins of the blood plasma and it exerts approximately 85 percent of the osmotic pressure provided by blood. It has been administered safely in concentrations up to 30 percent without untoward reactions and it can be stored in the liquid state without refrigeration. Experimental and clinical trials have proved it to be effective in restoring depleted blood volume resulting from shock and hemorrhage. Since 100 cc. of 30 percent human albumin will provide the same colloidal osmotic pressure, when injected intravenously, as 1,000 cc. of whole blood or 500 cc. of plasma, it is therefore possible to package albumin in a small compact unit ready for immediate use. The fact that albumin can be packaged in small containers is of tremendous importance to our military forces in that it may provide a method of restoring circulating blood volume among casualties in landing parties, among parachute troops, and to other casualties in places where the standard package of plasma cannot be made available. In an effort to make albumin readily accessible for use, should it prove to be equally as effective as plasma, the authors have proposed two methods of packaging the material (fig. 7). The first method proposed is to use an emergency type 30 cc. syringe with plunger and sterile needle attached ready for instant use (fig. 7b). The second method which furnished a much larger capacity (100 cc.) is also applicable and believed to be the method of choice in administering albumin (fig. 7a).

Although the results on the use of albumin are encouraging, further experimental and clinical data must be obtained before albumin can be unconditionally accepted as a satisfactory blood substitute to be used by the armed forces.

SUMMARY

Adequate experimental and clinical evidence has shown that properly prepared liquid, frozen, and dried plasma are satisfactory blood substitutes.

A standard package for the administration of dried plasma, applicable for use in the field, has been proposed and accepted for use by the Army and Navy. The manufacture of 200,000 units of plasma for the armed services is now under way. The standard package proposed is considered to be an acceptable method of administering plasma during military engagements.

Human albumin has been effective in restoring lost blood volume occurring as a result of hemorrhage and traumatic shock. Equipment for the use of this material in the field has been proposed.

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AN ESTIMATE OF SULFADIAZINE IN THE TREATMENT OF GONORRHEA

By Captain Robert P. Parsons, Medical Corps, United States Navy

The introduction of sulfanilamide in the treatment of gonorrhea in 1937 was such a striking advance that we soon looked back upon all phases of the gonorrhea problem of presulfanilamide days and thought of them as things belonging to the dark ages.

But quick cures were accomplished in only about one-half the cases with sulfanilamide and the toxic effects were so frequent and so worrisome that we hoped strongly for a more effective and a better tolerated drug. Our prayers were answered so well in 1940 by sulfapyridine that we cast out sulfanilamide just as completely and disdainfully as we had abandoned local treatment in 1937.

In less than a year sulfapyridine rightfully faded out when the definite superiority of sulfathiazole was appreciated. Sulfathiazole has now held its place securely for many months, and at this writing, in November 1941, is generally regarded as so nearly perfect that there is scarcely any room or need for improvements upon it. The change it has wrought have already been so far reaching that one has reason to wonder if this drug, with its power for quick destruction of the infectivity of the disease might not indeed bring about the virtual disappearance of gonorrhea in all enlightened countries.

Still, it is not entirely perfect. To be exact, it is only somewhere between 90 and 95 percent perfect. About 5 percent of the cases fail of a cure within 10 days and if we are so exacting as to demand a cure within 5 days, then about 10 percent of the cases could be classed as failures. Moreover, if we give more than 15 grams in 5 days or continue beyond 10 days with a daily dosage of 2 grams we are approaching the threshold of danger.

For these reasons we have not reached the ultimate in sulfathiazole, either as to speed and certainty of the cure, or as to its safety; and further searches for further improvements would seem entirely justified.

Because of its signal success in the treatment of pneumonia and its established advantage of superior safety, sulfadiazine (2 sulfanilamido pyrimidine) is at this writing being widely investigated as the most probable rival and possible supplanter of sulfathiazole in the treatment of gonorrhea.

The drug did not go on sale to the public until late summer, 1941 and as no published reports on results obtained in gonorrhea have yet appeared (so far as this writer knows), no extensive reference can be made here to the conclusions of others. Personal communications, however, disclose that one group of workers rate the drug as slightly slower than sulfathiazole in affecting cures, while a second group has completed a series of 57 cases with 98 percent cures and reports that an average total dosage of 17.5 grams in 8 days was needed for sulfadiazine as against 23 grams of sulfathiazole in 8 days to effect their cures. Their average duration of discharge was 4 days with sulfadiazine as against 3 days with sulfathiazole. A more interesting and perhaps more significant result obtained by the second group was that the time elapsing from the beginning of treatment to the appearance of the first negative prostatic culture averaged 13 days for sulfadiazine as against 28 days with sulfathiazole; and the time elapsing from the cessation of symptoms until the last positive prostatic culture (the so-called carrier period) was 3 days with sulfadiazine as against 17 days with sulfathiazole.

In the series of 30 cases reported here our clinical results were slightly better than those reported by the second group referred to above and this may have been for two reasons. First, we used a somewhat larger dose—18 grams in 5 days as against their 17.5 grams in 8 days. Second, there is a considerable personal element which enters into the grading of clinical values—one observer might class a urine as "crystal clear" while another would call it "slightly hazy," and one might fail to note a small shred in a glass of urine while another would class the same urine as "shreddy."

In this series, 30 cases were decided on for various reasons. Such a number is quite sufficient for forming definite conclusions provided each case is well controlled, carefully observed and diligently followed after the completion of the clinical cure. Also, any toxic properties would have ample chance to show themselves in their various forms in a series of this size. Also, to obtain a much larger series would, in these days when gonorrhea is becoming unbelievably

scarce in the United States, require a very long time in any but the largest clinics. As it were, it took from February 1, 1941, to October 30, 1941, to collect and complete the series. The first twenty were collected at the Washington Naval Hospital; the last 10 at the Portsmouth, New Hampshire Naval Hospital. Each case admitted was placed in the series, provided it was a new infection and no treatment had been received prior to admission.

All the patients were healthy young men, the ages ranging from 20 to 25 inclusive. All were strict hospital cases but none were put to bed. All remained ambulatory and were assigned to cleaning and messenger details which required a few hours of physical activity daily about the wards and grounds. We rarely had more than one case under treatment at one time, and never more than two, so that it was a very simple matter to make detailed observations daily as to the clinical progress, white counts, any toxic symptoms, amounts of physical exercise, etc.

A positive smear was obtained in each case before starting treatment. The incubation periods ranged from 2 to 14 days, with an average of 6.5 days.

The degree of severity at time of admission was graded and the cases distributed as follows:

1. Very mild (scant serous discharge and no subjective symptoms—2 cases).
2. Mild (scant purulent discharge and mild subjective symptoms—5 cases).
3. Moderate (moderate purulent discharge, moderate meatal inflammation, moderate subjective symptoms—8 cases).
4. Severe (profuse purulent discharge, marked meatal inflammation and severe burning on urination—14 cases).
5. Very severe (marked edema of meatus and prepuce, very profuse purulent discharge and severe pain on urination—1 case).

No relation was noted between the degree of severity on admission and the time required for cure.

The time elapsing between the appearance of the discharge and the beginning of the treatment ranged from zero days to 6 days, with an average of 1.8 days. No relation was noted between the duration of the "awaiting treatment" period and the time required for cure.

The routine dosage used was 4 grams daily for 3 days and then 3 grams daily for 2 days. The doses were divided so that the patient received 4 one gram doses on each of the first 3 days and 3 one gram doses on the fourth day and fifth day. When there was reason to continue the treatment beyond the fifth day (as in cases 5, 18, 23, 25) two daily doses of 1 gram each were given after the fifth day until cure was obtained. As will be seen in the table, only 1 case required treatment as long as the ninth day.

Case No.	Age	Incuba-tion period (days)	Treat-ment started (days)	Dis-charge ceased (days)	Urine clear (days)	Lowest W. B. C.	Cured (days)	Severity on admission
1	23	12	1	2	2	5,900	3	Mild.
2	22	2	2	1	2	5,200	2	Severe.
3	23	12	2	2	3	5,500	3	Mild.
4	20	7	5	4	4	5,800	4	Severe.
5	23	7	3	6	4	7,200	6	Do.
6	21	9	0	1	0	4,600	1	Very mild.
7	22	4	1	5	3	6,600	5	Moderate.
8	22	7	1	2	2	4,700	2	Severe.
9	24	7	3	3	3	8,800	3	Do.
10	21	2	2	3	2	6,400	4	Very severe.
11	21	8	0	1	1	5,700	1	Very mild.
12	20	6	2	2	2	5,000	2	Moderate.
13	20	5	1	2	2	5,400	2	Mild.
14	25	5	1	1	1	5,000	1	Moderate.
15	21	8	1	1	1	8,400	1	Severe.
16	23	14	2	2	2	6,800	2	Do.
17	20	4	1	1	1	6,600	1	Mild.
18	20	6	2	9	9	5,600	9	Moderate.
19	21	11	2	2	2	6,000	2	Mild.
20	24	6	1	2	2	6,500	2	Moderate.
21	20	4	1	2	3	5,500	3	Severe.
22	22	7	3	2	4	6,350	4	Do.
23	23	9	3	2	6	7,800	6	Do.
24	20	8	1	1	1	7,300	1	Do.
25	24	3	2	6	6	8,500	6	Moderate.
26	22	9	1	3	3	8,800	3	Do.
27	21	6	6	3	3	7,150	3	Severe.
28	24	4	1	2	1	7,000	2	Do.
29	25	2	0	2	1	6,300	2	Moderate.
30	22	2	5	4	4	7,800	4	Severe.

After treatment started, the discharge ceased in from 1 to 9 days, the distribution being as follows:

1 day	7 cases	5 days	1 case
2 days	13 cases	6 days	2 cases
3 days	4 cases	9 days	1 case
4 days	2 cases		

Average time for cessation of discharge was 2.6 days.

After treatment started both urine glasses became clear in from zero to 9 days. The one case classed as zero days was one in which the urine was clear at the onset and remained so. This patient (case 6), was in the hospital for another condition and presented himself at the urological clinic a few minutes after he first noted a tiny drop of discharge. No other signs or symptoms were present and one would scarcely suspect gonorrhea were it not for the typically positive smear. The distribution as to time required for clearing both urines was as follows:

0 days	1 case	4 days	4 cases
1 day	7 cases	6 days	2 cases
2 days	9 cases	9 days	1 case
3 days	6 cases		

Average time for urine clarification was 2.7 days.

Clinical cure was counted as the first day of dry urethra and two crystal clear urines beyond which there was no reappearance, either of a "morning drop" or of a haziness in either urine. On this basis

the average time for cure was 3.0 days, the distribution being as follows:

1 day _____	6 cases	5 days_____	1 case
2 days_____	9 cases	6 days_____	3 cases
3 days_____	6 cases	9 days_____	1 case
4 days_____	4 cases		

White counts were taken in all cases on admission and on alternate days thereafter during treatment. There was some drop of the white count in every case after admission, the usual drop being about 2,000, but as there was a mild leucocytosis in nearly every case at time of admission, the lowest count obtained during treatment was 4,600 (case 6). This count was obtained 2 days after starting treatment and further treatment did not result in any further drop or in the appearance of any toxic symptoms.

Not a single patient offered any complaint or showed any signs of a toxic nature and many of them volunteered the information that they were not aware of the slightest feeling that they were taking any drug. They evidently could all have remained at vigorous physical work but it cannot be said on this meager information that they might reasonably have been allowed to engage in hazardous occupations requiring extreme alertness.

In connection with toxicity, 2 cases not in this series should be cited here. One of them had previously been treated with sulfapyridine (3 grams daily for 5 days) with apparent cure, but had developed a generalized erythematous rash on the 5th day. Ten days later the discharge recurred and treatment with sulfathiazole was started. Before completing one day of treatment it had to be discontinued because the patient developed urticaria and temperature 101. He was then given local treatments with silvol for a month without benefit. Our first supply of sulfadiazine then arrived and we were hopeful that we could cure him with it. After one dose the urticarial rash appeared, the drug was stopped, and by evening the temperature reached 104. He recovered from the effects of the drug the next day but not from the gonorrhea for several weeks. In the other case, sulfapydrine had previously been given (3 grams daily for 5 days) with apparent cure. Two days later the discharge recurred and treatment was begun with sulfathiazole. The next day it was discontinued because of rash and fever. He then received local silvol treatment for 10 days without improvement. The sulfadiazine then arrived and we started him on it. Within a few hours after the first dose the entire skin was lobster red, temperature was 102, and the drug was discontinued. He also recovered from the drug the next day, and from his gonorrhea 8 weeks later. In both of these cases the trouble appeared to be an allergic

one and it is believed that patients showing this type of reaction to one sulfonamide drug will react similarly to all sulfonamides.

A few of the more unusual cases in this series should be cited here in very brief form:

Case 7.—Admitted with delirium tremens after a debauch of 3 days. Despite the well-known unfavorable effect of alcohol on the clinical course of gonorrhea, the patient was cured in 5 days.

Case 10.—This was the most severe case of the series. There was marked inflammation about the meatus, marked edema of the prepuce, very profuse purulent discharge and marked pain on urination. The urines cleared in 2 days, the discharge ceased in 3 days and the edema subsided in 4 days. No recurrence under prolonged follow-up observation.

Case 18.—This case was a moderately severe one on admission but was apparently cured on the third day. A special exception was made in this case, the patient being returned to duty on the third day because his services were urgently needed at his station. He returned on the sixth day with a recurrent discharge and by the ninth day he had obtained a permanent cure.

Cases 15, 16, and 20 had had previous infections, in 1937, 1940, and 1939 respectively; but their clinical courses did not vary materially from the average of the others.

Neither blood level determinations nor prostatic fluid cultures were done routinely in this series. Blood level determinations are of academic interest only and especially so when the drug is being used on healthy patients and in a dosage well below the known toxic amounts. This study was for the purpose of determining the usefulness of the drug in gonorrhea in the Navy. As blood levels can only be done conveniently at hospitals, they should scarcely enter into the problem of Navy gonorrhea, since with modern chemotherapy there is practically never any necessity for transferring a gonorrhea patient to a hospital. The question of culture of prostatic fluid is much more important (in order to recognize carriers) but this can only be done readily in hospitals, and as restriction of liberty is (or should be) enforced for one month after clinical cure, the practical problem of prevention of the dissemination of the disease among the civilian populace is (or can be) solved.

SUMMARY

A series of 30 consecutive hospital admissions of early acute gonorrhea in the male, and treated with sulfadiazine, is presented. Within 10 days after treatment was started cure was effected in 100 percent of the cases; within 5 days after treatment was started, 87 percent of the patients were cured.

CONCLUSIONS

Sulfadiazine is a safe and powerful drug in the treatment of gonorrhea. As compared with sulfathiazole it appears to effect the cure

just as rapidly, and this study indicates that it is definitely less toxic than sulfathiazole, gram for gram or therapeutic dose for therapeutic dose.

ACKNOWLEDGMENTS

A REVIEW OF FISH POISONING IN THE PUERTO RICO-VIRGIN ISLANDS AREA

A REPORT OF TEN CASES OCCURRING ON CULEBRA ISLAND

By Lieutenant Commander Robert L. Gilman, Medical Corps, United States Naval Reserve

A situation exists wherein at certain times of the year and in various fishing grounds in and about St. Thomas, V. I., several species of fish normally edible become poisonous as food. The literature dealing with this problem is limited in scope and content. The available references are concerned mainly with the bare reporting of cases, the species involved, the time of year and regions affected. No studies of the suspected fish have been made; limited facts only are available about the clinical study of the victims; but because no fatalities have been reported no pathologic or post-mortem studies exist. Theories only are advanced for the nature of the toxin although it is fairly well established that the toxemia is not infectious in origin. The toxin apparently exists in certain parts of the fish, usually of larger varieties, and seems to be present coincident to a change in feeding and breeding habits.

The cases of poisoning reported have been fairly well confined to a small number of species. Those reported as poisonous at one time or another in this area (Puerto Rico-Virgin Islands) have been:

I. CARANGIDAE (Jacks)

Amberjack or madregal _____ a. *Seriola falcata.*
Yellowjack _____ b. *Caranx bartholomaei.*
Skipjack or cavalla _____ c. *Caranx ruber.*
Horse-eyed Jack, jurel _____ d. *Caranx latus.*

II. SCOMBRIDAE (mackerel)

Kingfish or sierra (cera) or pintado _____ { a. *Scomberomorus cavalla.*
                                                             { b. *Scomberomorus regalis.*

III. SPHYRAENIDAE

Barracuda (large variety) _____. a. *Sphyraenidae barracuda.*

IV. LUTIANIDAE

Red Snapper_____ a. *Lutianus aya.*

While other fish may have accounted for an occasional instance of fish poisoning, the above species have been the most frequent offenders. In practically all of the cases the fish in question had been large adult specimens usually caught during the spawning period. The most consistent offenders have been the large, 20 pounds and over, barracudae and members of the Carangidae family, often the horse-eyed jack. Scott adds (quoting the natives) that if there is an exudation of a whitish watery fluid when the fish is cut up or if there exists a black or purple discoloration at the base of the teeth the barracuda is considered poisonous. Gatewood says that it is safest to discard any *caranx* which has not a well-defined black spot on the gill covers. Certain natives will feed suspected fish to a duck to determine if poison is present. A commonly held belief is that if the head of the fish be boiled with a silver spoon and the spoon darkens, that fish is poisonous. The toxin is not removed by any of the methods of cooking or by preliminary salting prior to its preparation as a food. Some authorities do believe that a prolonged period between the catch and its use as food, or a lack of proper refrigeration may contribute to its toxicity.

The occurrence of outbreaks of fish poisoning has been noted yearly in Cuba, Puerto Rico, Virgin Islands, Jamaica, Barbados, and Turks Islands. O'Neill noted certain specific regions relevant to Puerto Rico, near Sail Rock, St. Thomas, Culebrita, and the north coast of Vieques—particularly in November, December, and January, when, with northeast trade winds, the fish shift their feeding grounds. In O'Neill's reported case, the poisonous fish was a large female amberjack containing roe. The kingfish has given trouble in late winter when the fish swim in schools and are spawning. Scott reports instances of barracuda poisoning when the fish are caught north of Necker Island near Virgin Gorda. Walker, in 1922, reported 34 cases of fish poisoning occurring about St. Thomas in the months of August and September 1918. The fish was most often a *caranx*, and this observer stressed that the fish giving the trouble were those obtained through the use of deep-sea fish pots. The time of year and the depth of the catch seemed to point to a phenomenon of spawning. For the most part, and according to reported cases, poisoning from fish occurred mainly in the late summer, usually about September, or during the winter months, depending on the species and its breeding habits. No case had been noted after March or before August, until the recent investigation of 10 cases in May 1941, hereafter reported.
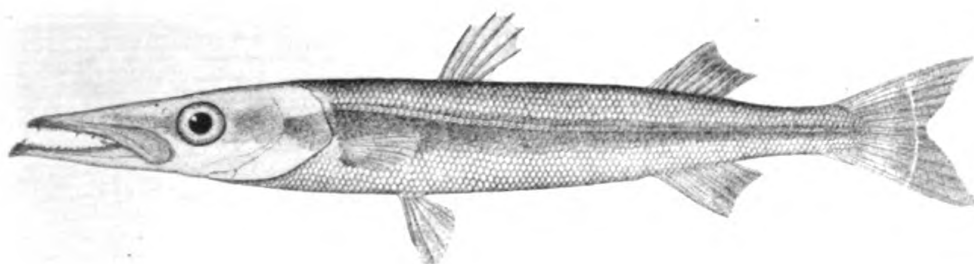
SCOMBEROMORUS BARRACUDA.

THE CERO OR KINGFISH.
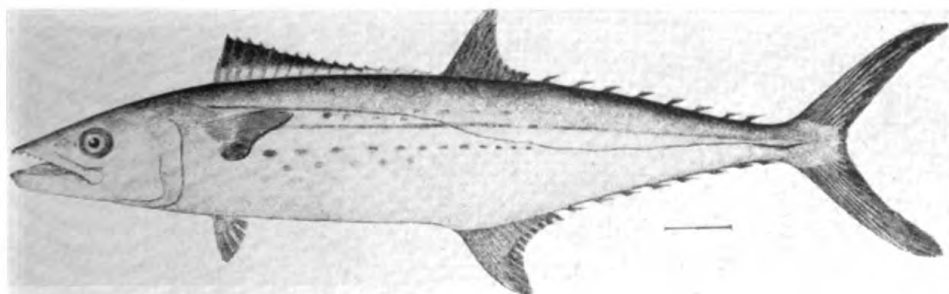
THE SPOTTED CERO.

(THESE CUTS ARE REPRODUCED THRU THE COURTESY OF THE PHOTOGRAPHIC SECTION, UNITED STATES DEPART-
MENT OF THE INTERIOR.)
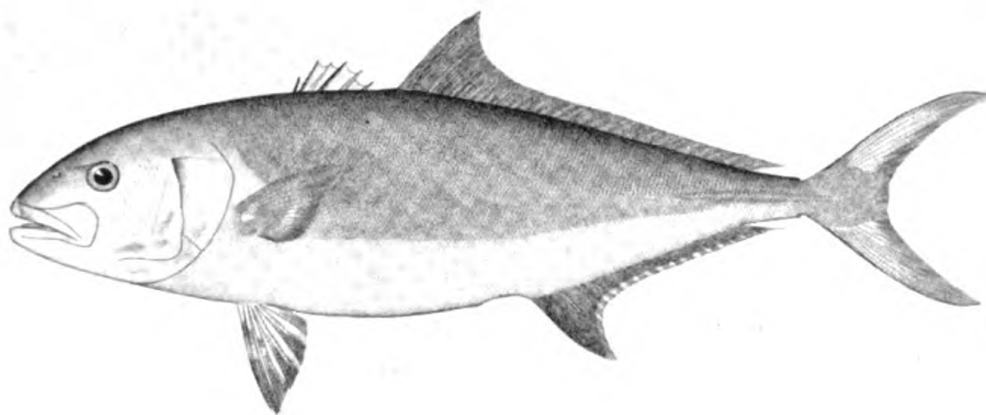
Seriola Falcata—Amberjack or Madregal.
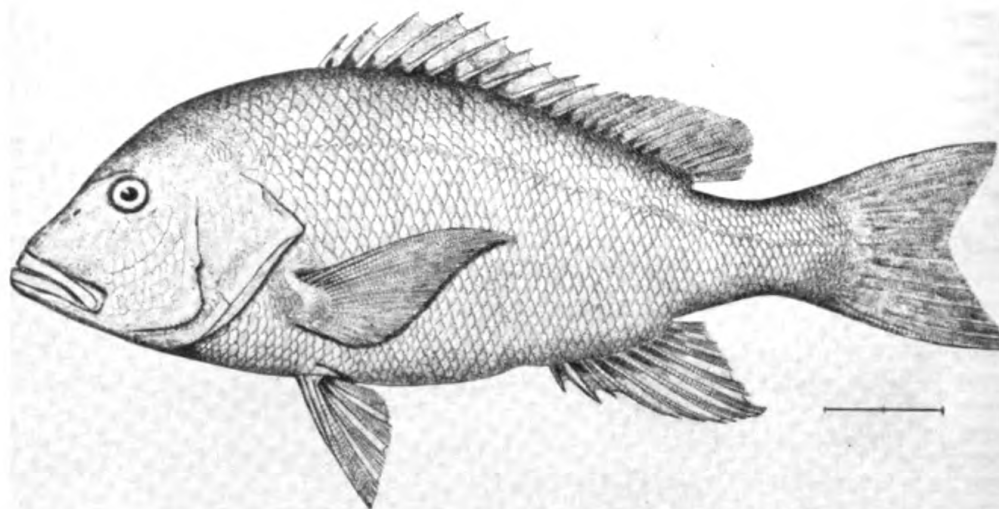
Lutianus Aya—Red Snapper.

(THESE CUTS ARE REPRODUCED THRU THE COURTESY OF THE PHOTOGRAPHIC SECTION, UNITED STATES DEPART-
MENT OF THE INTERIOR.)

SYMPTOMS

The symptoms of fish poisoning in the Puerto Rico-Virgin Islands region are clear-cut and may be considered almost pathognomonic. Mann's observations are definite in this respect and he gives them as follows:

Onset.—The onset is from 1 to 6 hours after eating the fish. The patient appears critically ill with severe gastro-intestinal symptoms of nausea, vomiting, and diarrhea. There is a distinct metallic taste. The skin becomes flushed and there is tingling and itching that may last for days. Cramps in the extremities may occur. Subsequently there may be weakness in the legs with possible temporary paralyses with reduced or absent knee jerks. Hyperaesthesias and paraesthesias are commonly associated. (The latter causing the patient to interpret a cold object as feeling warm or cold food as being hot.) There may also be associated nervousness, restlessness, or insomnia; albumin and casts and frequency of urination are prominent symptoms.

Course.—The course may run from 1 to 3 weeks with gradual recovery. No fatalities have been recorded. Mann regards the metallic taste and the paraesthesias (in which cold feels hot or gives a hot sensation in the mouth) as being the significant pathognomonic symptoms of fish poisoning. It does seem as if this definite chain of symptoms and their character may furnish a valuable lead in identifying the nature of the toxin involved.

The symptoms differ from those reported following ingestion of certain *tetrodon* fish found in Hawaiian and Japanese waters in which the active toxin, a leucomine, has been isolated. In these instances the onset often appears within 15 minutes, and while gastro-intestinal symptoms predominate there is a marked "burning sensation" and the mortality is high and fairly prompt.

Likewise there is no significant association between the clinical signs and symptoms of fish poisoning with those reported from the ingestion of the fruit of the manchineel (vide infra) in which there is a predominance of local irritation as in a caustic poison. Poisoning from small amounts of copper is almost too rare to seek a comparison.

ETIOLOGY

Considerable speculation exists regarding the fundamental cause of fish poisoning. Before considering the individual theories it seems advisable to list as many facts and beliefs concerning the nature of the poisoning as are known or held.

1. The poisoning is not confined to a single species or related species.

2. Not all fish of the same species and size, caught at the same time and place are poisonous.

3. Variations exist in the relative frequency of poison cases such as occasional examples following the eating of kingfish, a higher incidence after eating the larger barracudae, and a more frequent occurrence following the eating of a *caranx*.

4. The occurrence of fish poisoning is definitely seasonal and varies with the location and depth of fishing.

5. The smaller-sized fish are much less apt to prove poisonous (never, some believe), while the larger-sized are more apt to prove poisonous especially those spawning.

6. While not all those eating fish that have been established as poisonous are affected to the same degree, both whites and natives seem equally susceptible.

7. One experience of poisoning confers no immunity.

8. There exists no evidence that the poison is bacterial in origin, nor does thorough cooking prevent the poisoning.

9. It is believed, however, that a shortened interval between the catch and its consumption minimizes the poisonous effects (theory).

10. The symptomatology is definite, distinctive, pathognomonic.

11. The natives believe that certain changes are visible in the flesh of the fish indicative of their poisonous character.

While the actual cause of the fish poisoning is not known, considerable speculation has occurred concerning the true nature of the toxin. The possibility of a bacterial origin either primary or as a contaminant cannot be entirely dismissed although the general concensus, in view of all the available facts, does not consider such causation as being reasonably tenable. Earlier observers stressed the importance of shortening the interval between the time of the catch and its consumption as food. However, instances of poisoning have been recorded even after a short interval between the catch, its salting, refrigeration, and consumption.

Because of well-recognized and authenticated observations concerning the incidence of poisoning, such as a seasonal variation, a geographic distribution, and the fact that usually only the larger varieties of the species became poisonous, it seems reasonable to postulate the formation of an endogenous toxin concerned either with the feeding or spawning or both. Most often it is the mature spawning fish that proves poisonous; and from the knowledge of *tetrodon* fish poisoning, and the location of the specific tetrodon principle in the ovaries and roe, an analogy may follow. The occurrence of poisonous changes at spawning seasons in association with a change in food or feeding habits or contamination of feeding grounds has supported the belief of the exogenous origin of the toxin. Several such sources may be examined including the cabriza (a marine alga), the manchineel berry and copper contamination of the feeding-spawning areas.

There is no definite knowledge that the ingestion of cabriza by the fish or by the smaller fish on whom they feed is at fault or even occurs. This may be entirely a belief of the native population more in line with superstition than actual observation. However, the belief is worthy of further study in support or disproof of the idea.

The manchineel berry is known to be poisonous to man, and a clear-cut chain of symptoms is recognized from their inadvertent ingestion. The tree, *Hippomane mancinella*, is an evergreen of varying height and grows along the coastal regions and banks of certain of the suspected areas, (Mona, Culebra, Vieques, St. Croix, and St. Thomas). The fruit and milky sap have poisonous qualities when taken internally and although the poisoning is mainly that of a severe gastro-intestinal irritant it also affects the eyes and the mouth as a local irritant. If such theory of origin of fish poisoning is correct we must assume that the fish has easy access to the fruit, that this severe irritant is harmless to the fish and that in turn the fish is able to change or synthesize a poison of a considerable different character which in turn is transmitted through the tissues of the fish to the ultimate consumer. The weakest link in this chain of reasoning exists in the high degree of improbability that the fish really do have access to the berries near the banks, and that the fish (or the smaller fish on which they feed) really ingest the fruit.

A favorite and frequently quoted view of the causation of the poisoning has been the possible contamination of the feeding and breeding grounds of the fish by copper. This might well occur from the proximity of copper mines and old copper bottoms in the vicinity of the poisoning areas. Invoking again a train of reasoning we do know that usually only the larger members of the species become poisonous (spawning adults), and that the fish are not poisoned, that copper at least in such small amounts is an unlikely poison to humans, but that copper is present in the feeding-breeding areas. But the presence of copper cannot be overlooked, and indeed might be actually suspected in view of its known ability to act as an activator, catalyst, or combining agent. In the small amount present it could scarcely serve as a poison to either fish or man, although it may be that a biochemical affinity activates the organs of the sexually active fish under certain circumstances permitting or favoring the production of a toxalbumin and thus enabling the fish to produce a true toxin. I believe that of the three locally accepted beliefs, theoretically the copper contamination view holds out most interest and possibilities for further investigation.

The problem varies directly not only with the amount of fishing done but with the more complete utilization of fishing as an essential industry in providing food for local consumption. Were certain fish known to be poisonous at all times the problem would have considerable less interest. Its management would be simple. However, the fact that certain fish of recognized food value and popularity may only occasionally prove to be poisonous is worthy and necessary of investigation. Even if one were to regard arbitrarily all the local carangidae and barracudae as poisonous and regulate their take and forbid their use or sale as food, there still would be sporadic cases of poison-

ing from the larger kingfish, mackerel, and possibly some others. The poisonous fish cannot consistently be recognized by any infallible test or observation so that a study and determination of the source of the poisoning and methods of prevention constitute a problem vital to a people who, because of instability of food supply, must or should depend much more on fish as a source of food.

Because most of the reported cases of fish poisoning in this area have occurred in but two consecutive 3-month periods (August to October and November through January) few instances are seen or are available for study after March or before August. Hence the recent occurrence of 10 instances of fish poisoning on Culebra Island following the ingestion of a 20-pound barracuda has offered the first opportunity for clinical study of these cases "out of season."

On May 24th, 1941, Lt. Comdr., Warren E. Klein, Medical Corps, stationed at St. Thomas, V. I., learned that there had been some recent cases of fish poisoning on Culebra Island. He visited the island that day and found that earlier in the week, May 20th, 10 natives all eating of the same barracuda caught the previous day were all affected by what appeared to be a definite fish poisoning. It was learned that on the previous day, one of the island fishermen had caught a 20-pound male barracuda off Luis Pena Cay while trawling in deep water. The fish was cleaned and salted but not refrigerated, and portions of it were given to seven families on the island. The fish was cooked and eaten the following forenoon, and all of the 10 who ate the fish were poisoned to varying degrees. Three cats who later ate some of the flesh died, while one small dog became ill but subsequently made an uneventful recovery.

On May 25th, I visited Culebra Island and in the company of Dr. Klein interviewed and examined six of those affected. The remaining four were not seen as they were not in the vicinity and it is presumed that they had recovered sufficiently to return to their work. Most of those poisoned ate the fish sometime in the morning or noon of the 20th, at least 20 hours after the catch. The incubation period varied from a few minutes to an average of 3 hours after eating the fish, although in one instance no symptoms appeared until 20 hours after the ingestion of the fish. The main symptoms recounted were paraesthesias of the mouth, lips, and tongue, gastro-intestinal complaints, an itching skin eruption with nervousness, weakness of the limbs and joints, visual disturbances and a coppery or metallic tase. The main residual physical findings were gall bladder tenderness and diminished or absent knee jerks. The oral paraesthesias were interesting in their variety and included tingling and burning of the mouth, lips, and tongue; numbness in these same locations; coppery and metallic tastes; "hot breath," a feeling as though the teeth were loose; itching of the

mouth and lips, and the occurrence of cold foods and liquids being recognized as hot when taken into the mouth.

CASE REPORTS

Case 1.—A woman of 42 ate some of the fish at 9 a. m., and her symptoms appeared by noon, 3 hours later. She complained of nausea, vomiting and diarrhea. She remained acutely ill for 3 days with 2 nights of nervousness and insomnia probably associated with a severe pruritus that followed on the second day. She described a numbness of the lips, a heavy tongue with some speech difficulty and a coppery taste in the mouth. On examination she appeared somewhat recovered although still complaining of cramps in the extremities, some weakness, and still showed signs of an excoriated skin. The knee jerks were absent.

Case 2.—A girl of 15, daughter of the woman patient above ate the fish at the same time as her mother, and became ill 3 hours later with nausea, vomiting and diarrhea. She also had sharp pains in the head and abdomen and experienced double vision. The skin was not involved nor were any paraesthesias described. She had been "quite ill" but showed no ill effects at the time of the examination 5 days later. The knee jerks were absent.

Case 3.—A man of 50 ate some of the fish boiled with rice at 11 a. m. on May 20th but did not become ill until the following day at 9 a. m. He complained of weakness, excessive perspiration, numbness of the joints but with some occasional joint pain, and a "bad taste" in the mouth. He was restless, had not slept well, and said he felt as if his "teeth were loose." He had not complained about itching of the skin. He had experienced double vision, and at the time of examination complained of some visual impairment and a watering of the eyes. His knee jerks were not obtainable.

Case 4.—A man of 26, the fisherman who caught the barracuda, ate some of the catch on May 20th at 11 a. m., and became ill almost immediately. He experienced a sensation as of an electric shock. He trembled and could scarcely stand. His lips and tongue itched but he did not have general pruritus. He had some joint pains subsequently and an occipital headache. His weakness was such that he had not worked since. On examination his knee jerks were exaggerated.

Case 5.—A girl of 15, one half hour after eating a very small portion of the fish that had been boiled with rice had acute abdominal pain. Apparently she suffered a mild collapse with nausea and weakness. There was pain on flexion of the neck with occipital headache, and pain down the spine. She said that she could scarcely see, and that she had experienced some double vision. She had noticed a metallic taste, and that cold water seemed to burn her mouth. She had slight itching for 2 days, enough to give her insomnia. The duration of the major symptoms was 1 day. At the time of the examination there was still some tenderness over the dorsal vertebrae and over the gall bladder region. The knee jerks were normal.

Case 6.—A man of 29 who on examination was still confined to his bed, became ill 1 hour after eating the barracuda, and complained of a bad coppery taste, a numbness of the gums after drinking water, some visual disturbance with scotomata, and pruritus which he still had at the time of examination. He had been seen the previous day by Dr. Klein who found tenderness over the gall bladder and a palpable spleen. His present complaint was mainly weakness. The knee jerks were absent.

The remaining cases had been seen by the resident nurse, and their complaints in the main were abdominal colic, with diarrhea,

numbness of the legs with weakness, a "heavy mouth" and excessive perspiration. They had all made a prompt recovery. Two cats had died following the ingestion of the table scraps, while one sick animal was taken back to the School of Tropical Medicine for observation. This animal subsequently died and post-mortem examination showed no unusual findings. Examination of the brain and cord showed nothing abnormal either grossly or microscopically.

Treatment of the patients had been carried out under the supervision of the resident nurse on the island, and consisted mainly of rest in bed, castor oil, and mustard baths. None of the patients seen at the time of our examination was in need of any further treatment.

An interesting feature of this group of cases was that all who ate the fish were poisoned; all had similar symptoms with predominance of gastro-intestinal complaints associated with symptoms indicative of a neurotoxin (diminished reflexes, paraesthesias, and visual disturbances) and all made fairly uneventful recoveries. While we were investigating this group we learned that earlier in the month (May 1941) a kingfish caught nearby had proved poisonous to two natives who had eaten it.

The occurrence of fish poisoning during the month of May was unusual, we thought, this being the first reported instance of such, but subsequent questioning of some of the older inhabitants of Charlotte Amalie, St. Thomas, V. I., disclosed that in their experience most of their local cases of barracuda poisoning occurred in May, and that the caranx was also poisonous during May and June. Because a majority of the cases among the natives had occurred after eating the fish caught some hours previously and without refrigeration Dr. Knud-Hansen is of the opinion that a majority of the so-called cases of fish poisoning are really cases of intoxication from fish spoilage. However the cases reported in the literature previously and occurring among service personnel were all following the ingestion of fish freshly caught or completely and promptly refrigerated. Other residents were in agreement that most of the fish which later proved poisonous were caught to the east and south of St. Thomas, i. e., Smith Bay and Luongo Cay. The symptoms that made the most lasting impression were the weakness of the knees and the pruritus. Other fish that had proved poisonous in the past to residents of St. Thomas were the larger amberjack, kingfish, and some of the smaller mackerel. None of those questioned had any theories concerning the reason for the fish being seasonally poisonous, nor had they any way to detect the nonpoisonous from the poisonous fish other than certain native superstitions.

This account of fish poisoning has as yet contributed nothing to its causation although this may be considered as a preliminary

step toward an attempt to learn more concerning its nature. A logical procedure to follow will be the study of what may be thought to be normal specimens of the fish concerned to determine normal findings and the type of food found in the alimentary tract. A limited oceanographic survey of the grounds and levels at which the poisonous specimens are taken might shed some light on contamination of feeding grounds. The active part of the investigation would be feeding experiments with specimens of fish (when obtained) to determine gross toxicity in animals, and finally an attempt toxicologically at identifying and isolating the toxin which may be the active poison. A valuable lead in the identification of the toxin may be contained in the definite chain of symptoms seen in almost all reported cases of fish poisoning. The most important determination will be locating the source or genesis of the toxin so that steps might be taken to neutralize its occurrence, and thus a decadent industry be restored to the islands which need both the increased activity and a sounder source of food supply.

CONCLUSION

Pending recognition of the toxin and the agents producing it, it is recommended that the species of fish mentioned herein be avoided in certain seasons when caught in the Virgin Island-Culebra areas; that larger and spawning members of these species be avoided, and, finally, that the caranx and barracuda be avoided at all times.

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AUDITORY ACUITY AMONG SUBMARINE PERSONNEL

PART I

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The term "submarine ears" has long been applied to anyone in the Navy who has demonstrated any degree of deafness, and thus deafness came to be regarded as associated with submarine duty. It has been observed by the authors that many men of long submarine experience have normal hearing and thus we determined to investigate the allegation to find whether or not it was based on fact.

Deep-sea diving, Diesel engine exposure, gunfire exposure, and numerous other naval and industrial hazards have likewise come to be regarded as detrimental to hearing. Little or no accurate and controlled investigation has been done regarding any of these so-called naval hazards to hearing and it was decided, the necessary equipment being readily available at the Submarine Base, New London, Conn., to investigate the matter exhaustively.

In the course of this investigation over 1,500 audiometric examinations have been made. In all cases a complete otological history and physical examination were accomplished, including a record of any disease or injury incurred by the subject which might, in any way, affect the acuity of hearing.

Method.—For the first and major part of the audiometric examinations, we used a standard Western Electric 2A audiometer and for the latter part, a new standard Western Electric 6B audiometer. These instruments were calibrated in the factory and direct comparison of the two machines gave interchangeable results. Both machines were also checked against known normals and gave accurate readings throughout the entire range. A Hartmann tuning fork set was used with forks ranging from 128 (C) to 2049 (C4). The watch used for testing the hearing was an Ingersoll, although for a large group both the Ingersoll and a Navy standard stop watch were used. The whispered and spoken voice, and coin clicks were done in accordance with paragraph 1434, Manual of the Medical Department, United States Navy. The audiometric determinations were conducted in accordance with standard procedure either in a specially constructed soundproof room where the sound level was below 30 decibels, or under similar sound conditions in a room in the mine depot. The sound levels of the audiometric rooms and of the Diesel laboratory were determined by means of a General Radio sound level meter, type number 759 which was calibrated at the factory and again at this base.

The otological examination included the physical examination of the ears by otoscope, the determination of the watch tick, whispered voice, spoken voice and coin click for both ears in accordance with the instructions as noted above, the Weber test, the Rinne test, the Romberg, the Babinski-Weill, and examination for spontaneous nystagmus, with any additional comment deemed necessary.

The history of each individual included the following information: Date, name, age, rank or rate, ship or station, length of naval service, submarine service, deep-sea diving duty, lung training duty, aviation duty; and in the case of machinist mates, the length of time with various types of Diesel engines; and in the case of radiomen, the length of time standing regular radio watches.

A complete history of family deafness, difficulty in taking pressure, and of exposure to gunfire or explosion was taken. Routine gunfire exposure was considered to be that in which no more serious symptoms than slight loss of hearing for 15 to 20 minutes or ringing in the ears for about the same length of time had been experienced. Since almost all naval personnel have at times noted these minor symptoms they have, for the purpose of this investigation, been classified as "routine." Audiometric examination has demonstrated the correctness of this classification. The auditory threshold was determined by the "inaudibility to audibility" method and thus the ascending threshold is used throughout. The tone interrupter was used as a frequency check and audibility control.

Care was taken to have a complete understanding of the questions and to elicit a comprehensive history of frequent sore throat, colds affecting ears, bleeding from the ears, otitis media, otitis externa, perforated ear drums, sinusitis, mastoiditis, and any operative treatment of the ears, nose, throat, sinuses, or mastoids. Any history of diphtheria, scarlet fever, meningitis, and syphilis was also investigated.

The history automatically classifies the men in the following groups: Negative or normal, submarine duty, submarine machinist mate duty, submarine radio duty, diving duty, gunfire exposure, and, in addition, a large miscellaneous group in which there were additional positive factors other than those mentioned above or in which two or more of the above were positive for the same individual. Thus a submarine machinist mate might also have experienced an attack of scarlet fever as a child or had severe otitis media or had syphilis, any of which factors would eliminate him from the "pure" machinist mate submarine group and place him in the miscellaneous machinist mate group. There, of course, were others who had experienced severe gunfire trauma as well as having served in a submarine and thus must be included in the miscellaneous group. Those individuals having only one positive finding so far as the history was concerned, were classified as "pure" cases. Thus the "pure" submarine machinist mates are those cases giving a history of exposure to Diesel engines while on submarine duty and who gave no other positive history so far as trauma, accident, or illness that might affect the hearing. The "pure" machinist mate cases are presented as a separate group with the "miscellaneous" machinist mates composing an additional group.

HEARING LOSS DUE TO EXPOSURE TO DIESEL ENGINE NOISE

A. *Acute loss.*—This section concerns the acute loss of hearing, as determined by audiometric examination, due to exposure to the noise of Diesel engines for periods of 1, 2, 3, and 4 hours. The subjects were not selected men and they were not ruled out by a below average

"normal" or preexposure audiogram, for the study was relative to the individual's normal hearing and only acute changes were being investigated. A series of audiograms were run prior to exposure to determine the normal level and, routinely, a history and physical examination of the ears was taken.

The exposure was given in the Diesel laboratory at the Submarine Base to the 16-cylinder V. M. I. experiment X S–20 and to the 10-cylinder radial type Continental engines. The V. M. I. was the noisier of the two with readings as high as 122 decibels as measured by use of the General Radio type 759 sound level meter. This level varied with the position of the meter from 100 decibels at the most remote point in the building to 122 decibels near the air intake on either the port or starboard side at the after end of the engine. The area where the men spent most of their time varied from 108 to 112 decibels. The Continental engine produced over-all sound levels measuring 85 decibels minimum throughout the laboratory and 103 to 112 decibels in various positions near the engine. These over-all sound levels do not reach the intensity of the engine room of a submarine as a 126-decibel average over-all sound level was reported by Mr. Wohlberg for two of our new submarines with main engines operating at normal cruising speed.

However, the auditory trauma produced in the laboratory was sufficient to cause marked loss, as will be noted by reference to table 1, showing the results of 9 representative cases.

TABLE 1.—*Acute damage, submarine Diesel engines*

Cycles	Ear	Sensation units			Percent loss normal hearing		
		Normal	1 hour exposure	Loss	Normal loss	1 hour exposure loss	Difference loss
		Decibels	*Decibels*	*Decibels*	*Percent*	*Percent*	*Percent*
64	R	−0.2	+11	±10.8	+0.0	18.3	+18.3
	L	+3.7	+5	+1.3	6.7	8.3	+1.6
128	R	+5.52	+12.2	+6.68	6.8	13.6	+6.8
	L	+5.31	+9.6	+4.29	5.7	11.4	+5.7
256	R	+7.85	+18.77	+10.92	7.2	17.1	+9.9
	L	+7.86	+15.66	+7.80	7.2	14.4	+7.2
512	R	+3.70	+13.22	+9.52	3.2	10.5	+7.3
	L	+2.74	+13.33	+10.59	2.4	10.5	+8.1
1,024	R	−1.07	+10.00	+11.07	+.8	7.6	+8.4
	L	−1.50	+10.44	+11.94	+1.5	7.6	+9.1
2,048	R	+2.33	+19.55	+17.22	1.6	15.7	+14.1
	L	+5.70	+18.33	+12.63	4.7	14.1	+9.4
4,096	R	+17.32	+33.66	+16.34	14.7	28.3	+13.6
	L	+24.76	+41.33	+16.57	21.6	35.3	+13.7
8,192	R	+4.11	+18.77	+14.66	4.3	20.2	+15.9
	L	+7.30	+20.33	+13.03	7.4	13.8	+6.4
Average (all frequencies)				10.40			9.68

Note that the normal level was below average for men of their age but 2 men of the group showed marked permanent hearing loss due to other causes. After 1 hour exposure the men were taken immediately to the sound room and in every case and for all frequencies, there was noted an acute loss of hearing. There was an average loss for the group of 10.4 decibels, which amounts to an increased loss of hearing of 9.68 percent. This loss following 1 hour exposure requires about 5 hours to return to the original normal level for the individual.
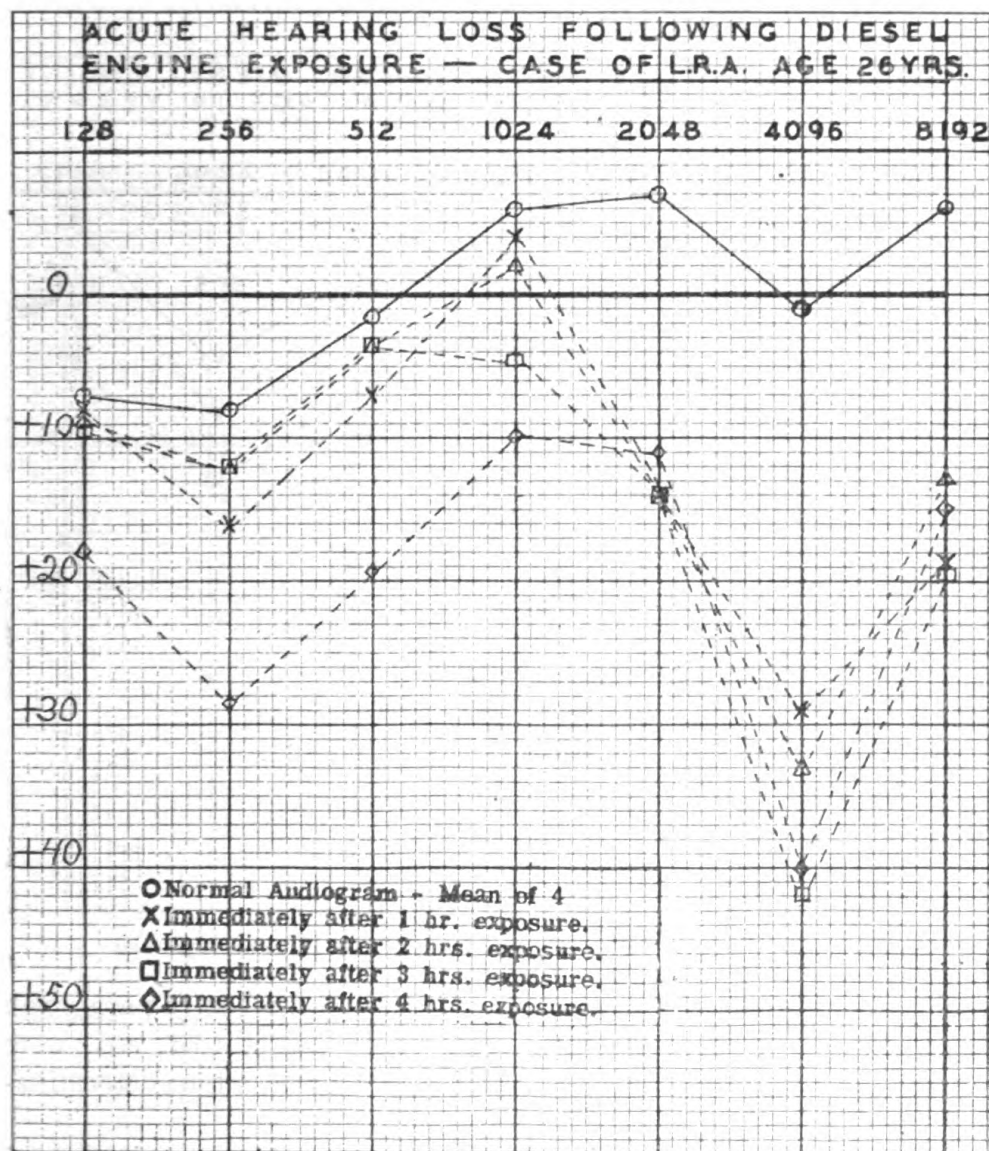
FIGURE 1.—Acute Hearing Loss Following Diesel Engine Exposure.

As seen in figure 1, the major part of the hearing loss is incurred during the first hour of exposure, with but a comparatively slight increase following the 2-, 3-, and 4-hour exposures. Yet, while hearing loss is only moderately increased, recovery time is greatly lengthened by increasing the time of exposure as is shown in figures 2 and 3. Following the 1 hour exposure (fig. 2), return to normal is practically

complete in 5 hours; whereas, following the 2-, 3- (fig. 3), and 4-hour exposures, it is not complete even by the following morning or 20 hours later.

B. *Permanent loss.*—In determining the permanent loss of auditory acuity due to exposure to the noise of Diesel engines, all available machinist's mates on the submarines stationed here or on the Base itself, providing they had served on submarines previously, were given
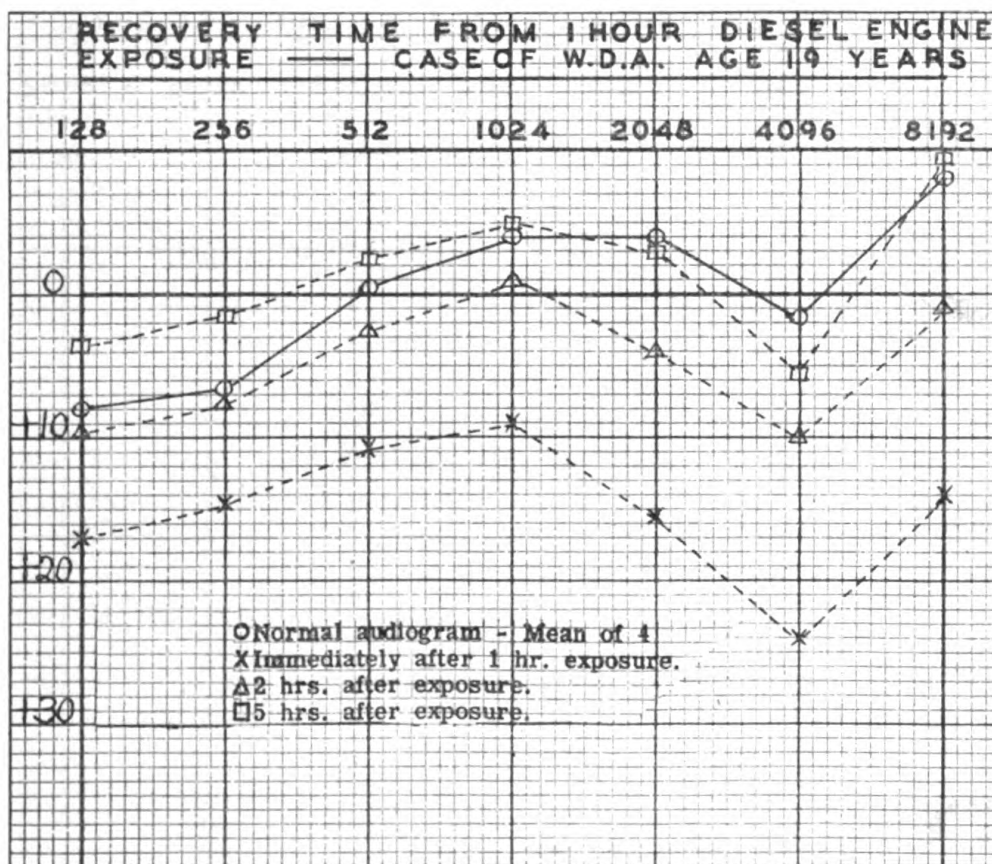
FIGURE 2.—Recovery Time From 1 Hour Diesel Engine Exposure.

audiometric and all of the other examinations described in paragraph A for "acute" loss. Men with acute colds, sore throat, etc., were excused until the condition had cleared in order that a true determination could be made.

A total number of 58 machinist's mates were thus examined. Of this number there were 22 who could be classified as "pure" inasmuch as they had no positive finding in their history other than service aboard submarines in the engine room. The remaining 36 were classified as "miscellaneous" machinist's mates since they had histories of disease, infection, accident or other conditions considered to have a possible bearing on their acuity of hearing.

TABLE 2.—*Permanent damage, submarine Diesel engines.*

	Ear	Frequency							
		56	128	256	512	1,024	2,048	4,096	8,192
Normal, ages 25–34	R	+0.5	−1.2	+4.8	+6.0	−0.2	+6.5	+10.1	+15.1
	L	+.9	−1.4	+2.9	+5.6	−.9	+5.3	+12.9	+14.9
Submarine machinist's mates "Pure", mean age 38.5	R	+6.9	+4.4	+12.2	+14.9	+7.7	+20.7	+44.3	+34.3
	L	+7.3	+4.7	+12.3	+13.9	+6.8	+21.2	+43.6	+33.4
Submarine machinist's mates "Miscellaneous", mean age 37.9	R	+7.2	+4.5	+12.0	+13.9	+5.9	+22.4	+43.5	+39.4
	L	+6.8	+3.3	+10.6	+11.8	+5.3	+25.4	+45.4	+38.0
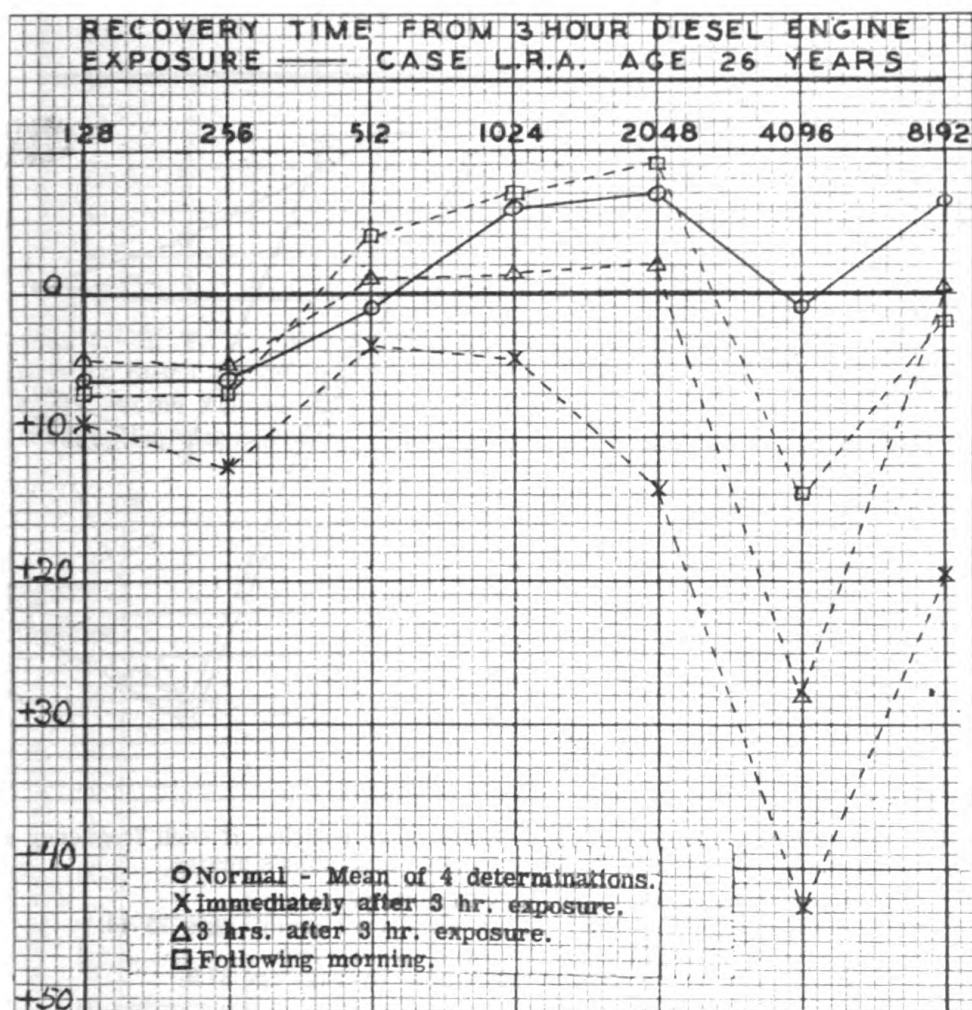
FIGURE 3.—Recovery Time From 3 Hour Diesel Engine Exposure.

Table 2 gives the arithmetic mean for the various frequencies for both the "pure" and "miscellaneous" groups and also as a comparison gives the mean for our group of normal subjects with an age range of 25 to 34 years; mean age 26.9 years; No. 23. This group gave negative answers to all of the questions in the history and had normal ears on otological physical examination and thus were used as the control or normal group. Our mean for the various frequencies was considerably less than that found for the same age group by the National

Health Survey (1) on 10,418 ears, but their criterion for normal classification was only that the subject consider his hearing normal, thus their group was not so sharply selected as ours. Neither were their testing conditions as well controlled as to soundproof rooms as were ours.

Figure 4 is a composite showing the binaural mean position at each frequency of our "pure" and "miscellaneous" machinist's mates. In the same figure is a composite of our normal group for the ages 25–34 and that of Public Health (1)
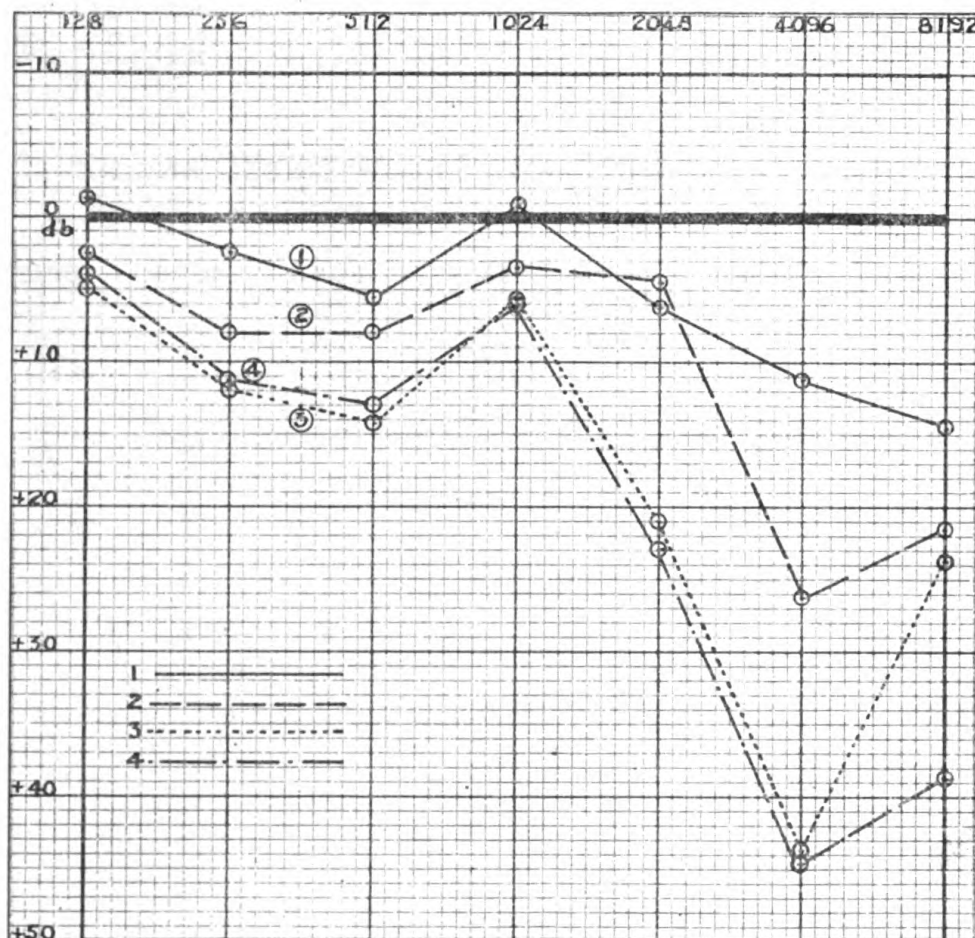
FIGURE 4.—A composite showing the binaural mean position at each frequency of our "pure" and "miscellaneous" machinist's mates.

1.—Our normal for 22 men, ages 25 to 34 years.
2.—Public Health normal for an unselected group, ages 35–44.
3.—Average of 22 "pure" cases—average age 38.5.
4. Average of 36 "miscellaneous" cases—average age 37.9.

in which the average age is 39.5. The average age for our "pure" group is 38.5 and for the "miscellaneous" 37.9. It is interesting to note that the loss for both groups runs parallel except for the 8,192 frequency in which there is a slight difference. In comparison with either normal there is shown additional loss of hearing for every frequency, which is exceptionally marked at 2,048, 4,096, and 8,192 frequencies. These composite audiograms of permanent loss show a remarkable resemblance to the audiograms of the men who had been given an acute exposure to the noise of Diesel engines.

Figures 5 to 10, inclusive, are 6 typical audiograms of permanent damage in "pure" cases. The legend under each figure gives the necessary information in each case. They illustrate clearly the predilection to damage in the higher
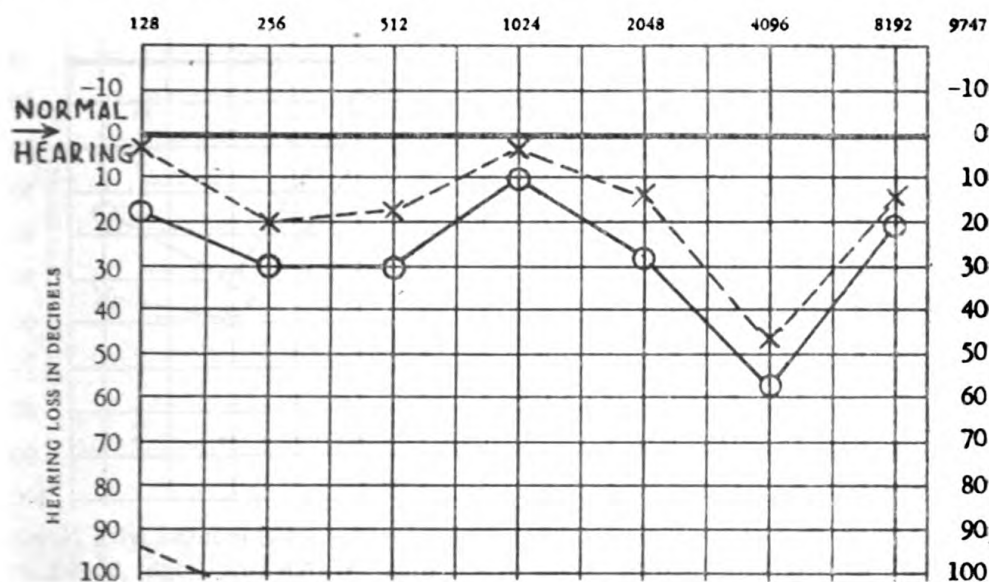
FIGURE 5.—R. T. W. Age 48 yrs. 20 yrs. Naval Service. 168 months with Nelsico, Busch Seltzer, and M. A. N. Diesel engines. Both ear drums thickened. Watch tick 14/40 both ears. Rinne positive. The remainder of the examination was negative.
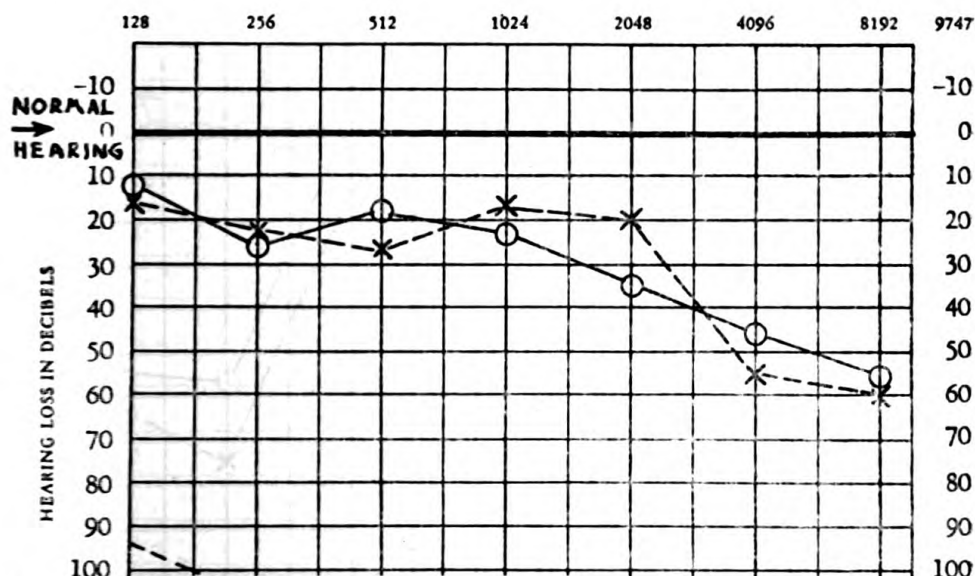
FIGURE 6.—T. H. C. Age 50 yrs. 20 yrs. Naval Service. 48 months with Nelsico and M. A. N. Diesel engines. Both drums thickened and dull. Watch tick—right 4/40, left 3/40. Whispered voice 13/15 both ears. Rinne positive. Remainder of the examination was negative.

frequencies. W. P. (fig. 8) is an excellent illustration of this for all frequencies approximate the normal except for 4,096 and 8,192 where the damage is extensive.
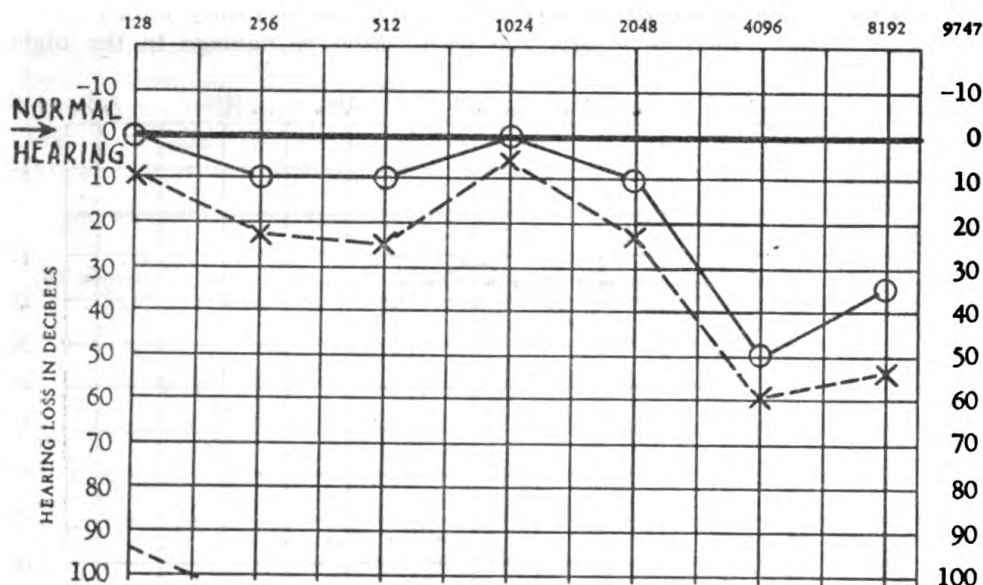
FIGURE 7.—J. E. F. Age 45 yrs. 20 yrs. Naval Service. 168 months with Nelsico and M. A. N. Diesel engines. Both drums dull. Watch tick—right 22/40, left 8/40. Rinne positive. Tinnitus left ear. The remainder of the examination was negative.
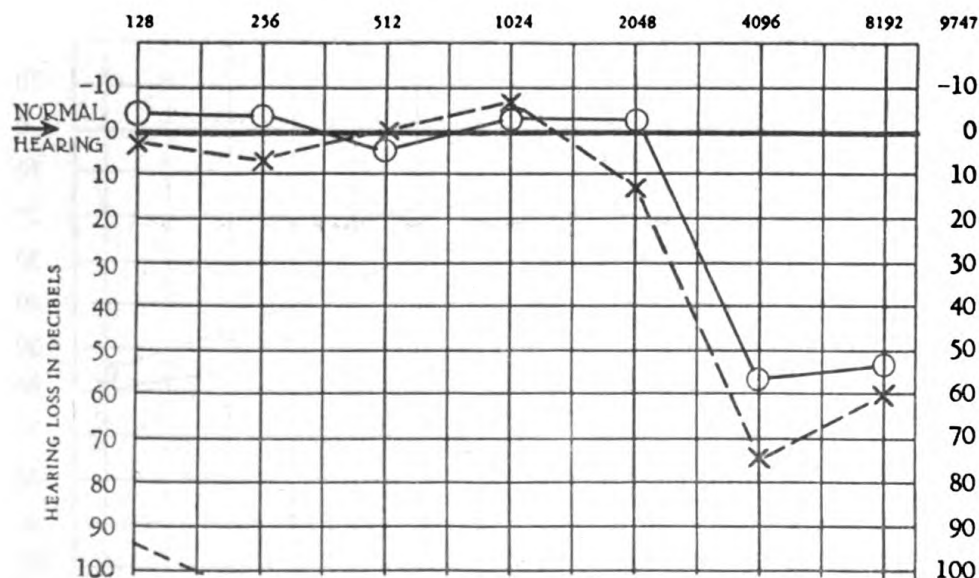
FIGURE 8.—W. P. Age 36 yrs. Naval Service 20 yrs. 156 months exposure to Diesel engines. Right drum large scar, dull and thickened. Watch tick—34/40 right and 32/40 left. Rinne positive. All other history and examination negative.
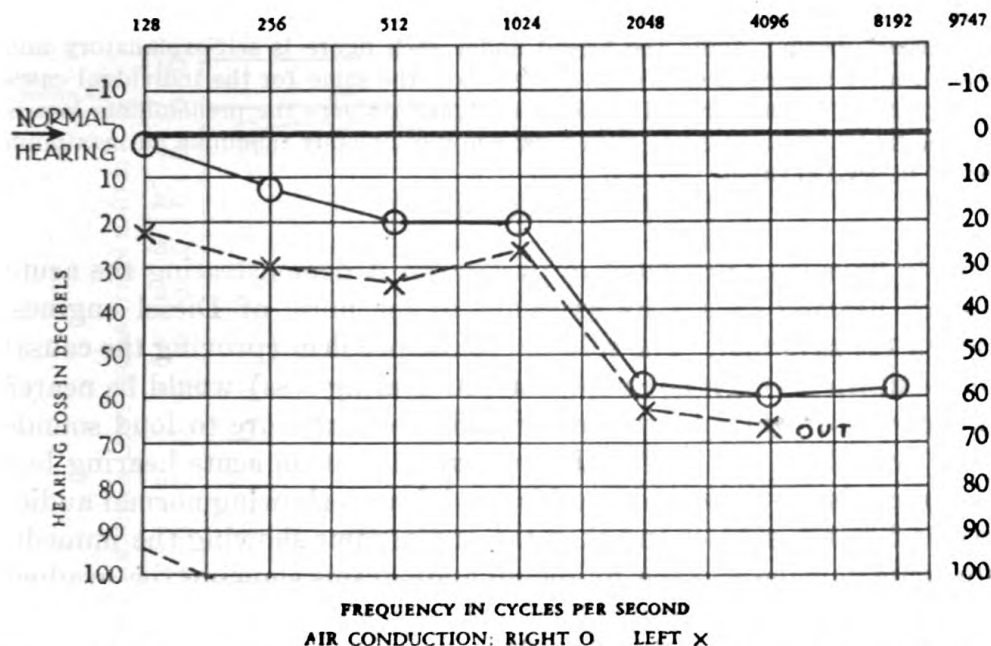
FIGURE 9.—F. A. D. Age 46 yrs. Naval Service 27 yrs. 24 months S/M Diesel engines. 36 months surface Diesel engines. 22 years engine room surface ships. Both drums slightly dull. Watch tick only on contact for both ears. Whispered voice, right 1/15, left 2/15. Spoken voice, right 10/15, left 12/15. Coin click, right 2/20, left 3/20. Rinne positive. Romberg slightly positive. History and physical otherwise negative.
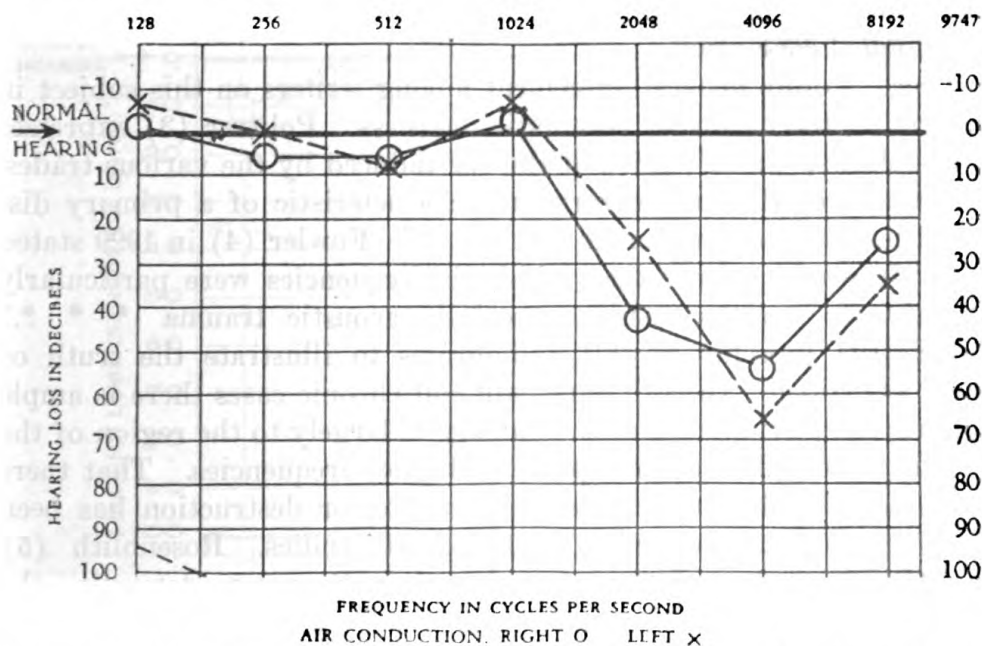
FIGURE 10.—G. E. W. Age 45 yrs. Naval service 20 yrs. 84 months Busch-Sulzer and Nelsico S/M Diesel engines. Remainder of time engine room surface ships. Both drums slightly thickened. Watch tick, right 18/40, left 3/40. Left ear, whispered voice 13/15, coin click 18/20. Rinne positive. History and physical otherwise negative.

In figures 11 to 14, inclusive, we present 4 illustrative cases from our "miscellaneous" group. Again the legend under each figure is self-explanatory and gives a brief history of each case. The loss is the same for the individual cases as that noted in the composite shown in figure 4 where the predominate loss is for the 3 highest frequencies with 8,192 being completely inaudible on maximum power in several cases.

DISCUSSION

Data have been presented in paragraph A demonstrating the acute loss of hearing caused by exposure to the noise of Diesel engines. Bunch (2) says that, "The solution to the problem (proving the causal relationship between noise trauma and hearing loss) would be nearer if records of hearing tests before and after exposure to loud sounds were available; * * *." In our experiment on acute hearing loss such records are presented in tables and figures showing normal audiograms for each subject and then the audiograms showing the immediate acute damage and the follow-up audiograms showing the gradual return to the original normal level. Thus the relationship between the acute noise trauma produced by Diesel engines and loss of hearing is conclusively demonstrated.

In paragraph B, data have been presented demonstrating marked permanent loss of auditory acuity far in excess of any that could be accounted for by age or other factors. That oft repeated acute trauma causing the acute damage noted above has resulted in permanent and irreparable damage so far as auditory acuity is concerned can be the only logical conclusion.

There is quite general agreement among writers on this subject in describing the nature of traumatic deafness. Politzer (3) expresses it as follows, "In affections of the ear induced by the various trades, the results of the tuning forks are characteristic of a primary diseased condition of the nerves; * * *." Fowler (4) in 1929 stated that "It would appear that mid-high frequencies were particularly sensitive to various insults, especially acoustic trauma * * *." Bunch (2) presents several audiograms to illustrate the truth of these assertions. In both our acute and chronic cases there is ample confirmatory evidence that the damage is largely to the region of the cochlea involved in the reception of higher frequencies. That there is an associated actual nerve degeneration or destruction has been demonstrated by numerous pathological studies. Rosenblith (5) in 1941 reported on a survey conducted in France to determine the relationship between the "intensity and frequency distribution of industrial noises and the hearing loss which is commonly encountered in noisy professions * * *. It was possible to show that there was some proportionality between the average noise level and the temporary as well as the permanent hearing loss for corresponding groups of workers. However, all attempts to relate the frequency
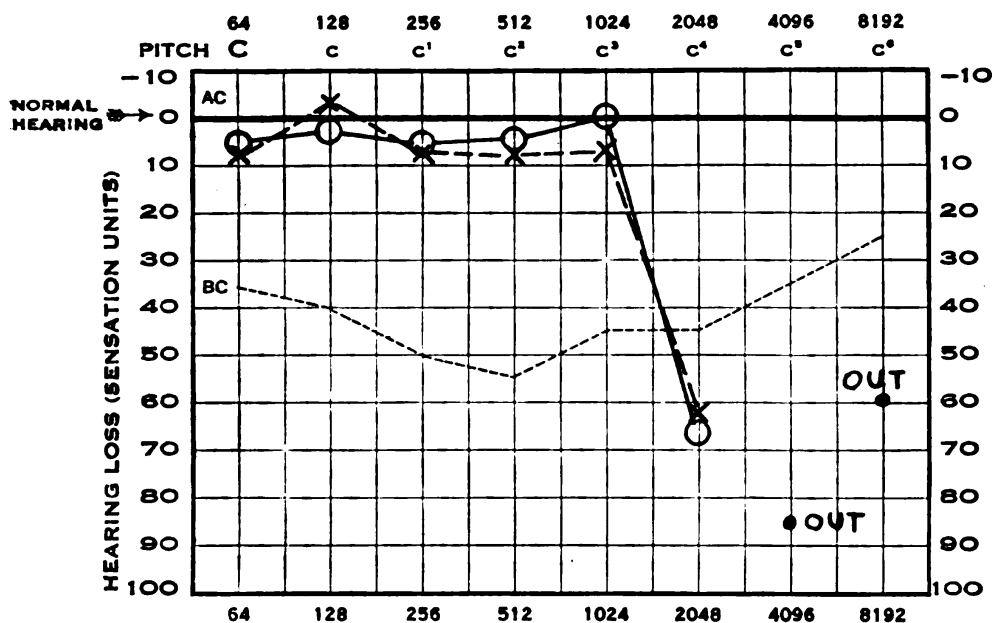
FIGURE 11.—S. J. C. Age 47 years. Naval Service 26½ yrs. In engine room on Eagle No. 55 for 11½ years and 7 years in the fire room under forced draft. Both drums dull. Watch tick contact only both ears. Whispered voice, 1/15 both ears. Coin click, 1/20 both ears. Rinne positive. History and examination otherwise negative.
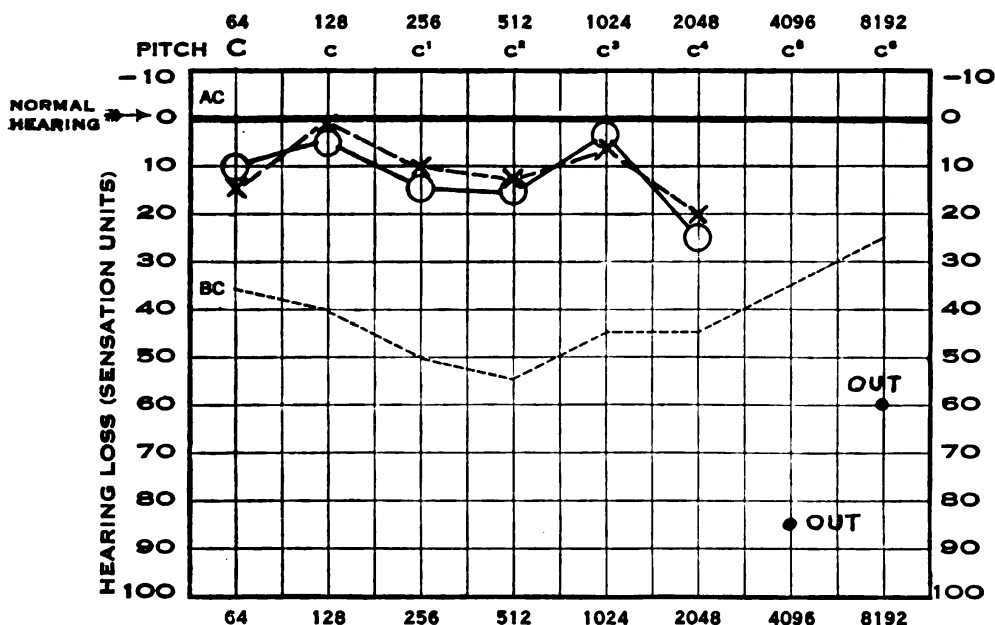
FIGURE 12.—L. B. W. Age 42 years. Naval Service 16 years. 20 months with Nelsico engines. Became overheated in engine room and became completely deaf for 2½ hours with but partial recovery, according to history. Both drums dull and thickened with evidence of chronic irritation in right. Watch tick, 1/40 both ears. Whispered voice, right 3/15, left 12/15. Coin click, right 2/20, left 3/20. Rinne positive. Weber to right. History and examination otherwise negative.
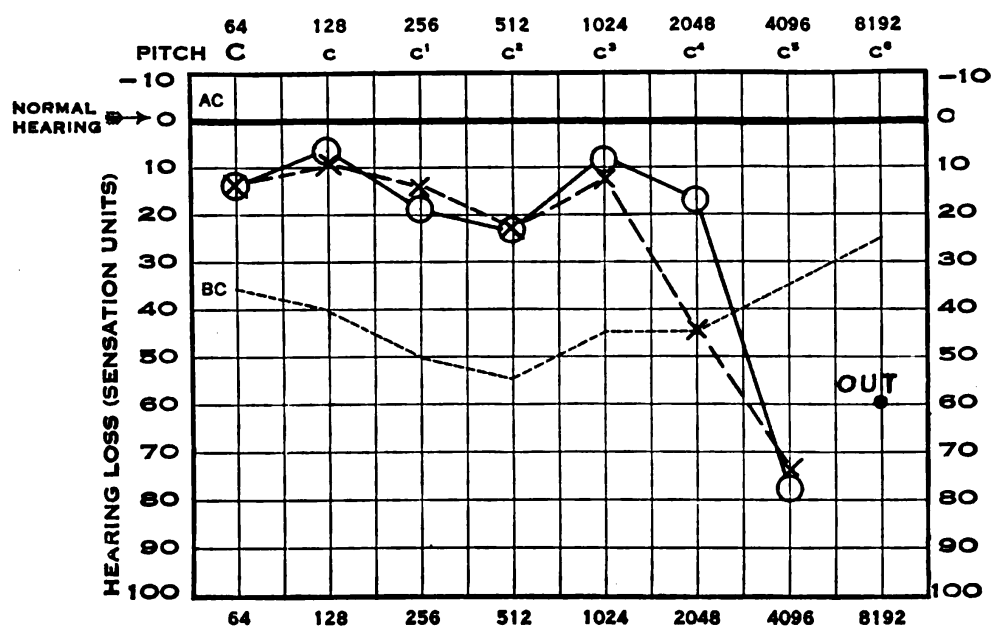
FIGURE 13.—N. T. W. Age 36 years. Naval Service 18 years. 143 months Nelsico and M. A. N. Diesel engines. Had diphtheria age 1 year. Well treated syphilis age 25 years. Left drum slightly dull. Watch tick 4/40 right ear and contact only on left ear. Coin click, 19/20 right and 17/20 left. Rinne positive. Weber to right side. History and physical otherwise negative.
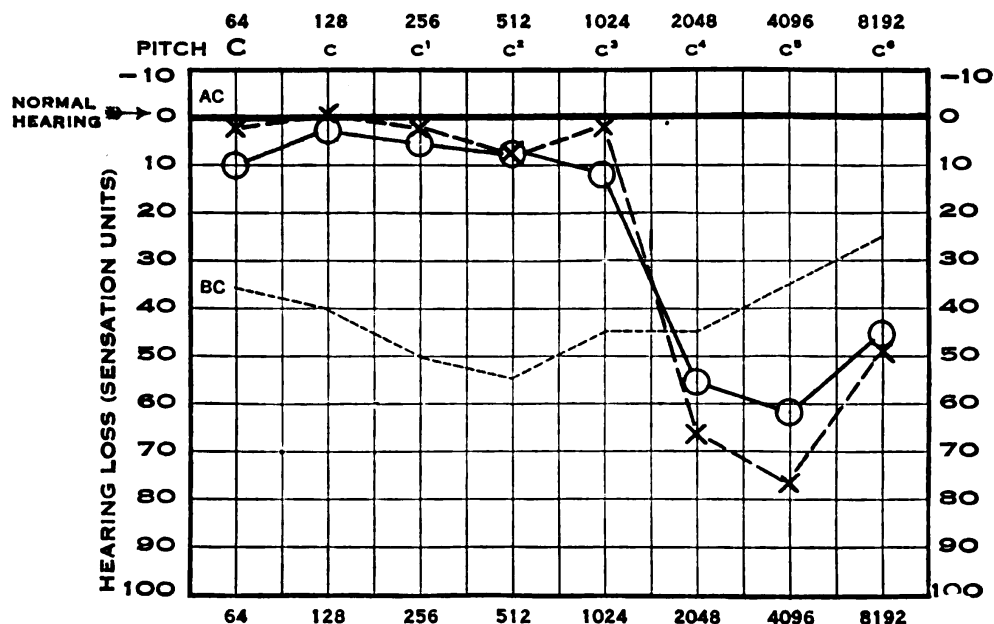
FIGURE 14.—W. T. P. Age 38 years. Naval Service 16 years. 48 months with Nelsico engines. Aviation—13 hours in the air. Syphilis age 35 years, well treated. Ear drums slightly thickened. Watch tick, right 2/40 and left 4/40. Whispered voice, right 6/15 and left 10/15. Rinne positive. History and physical examination otherwise negative.

spectrum of industrial noises to the corresponding hearing loss have failed so far, as the most important components of such noises are practically always below 1500 cycles while the hearing loss becomes severe for higher frequencies only." We find damage throughout the entire range with the major loss in higher frequencies. Certain other investigators also have reported this "high frequency deafness" after exposure to relatively "low frequency noises."

This loss of auditory acuity which we have shown, will of course reduce the efficiency of the individual so affected for communication by means of voice or sound and may lead to serious accident by failure to properly hear and execute orders or signals. Care should be taken to keep men who have become deaf out of positions where they will have to receive and relay or execute vital orders. Therefore, it is the opinion of the authors that the determination of auditory acuity should be given more weight in all physical examinations for selection of naval personnel. That there is marked slowing and loss of efficiency among personnel working under noisy conditions has been amply proven by many extensive studies such as the Aetna Life Insurance (1930) 2½-year test in which they found not only a general over-all increase in efficiency of 9 percent but an error reduction of 29 percent for the typists and of 52 percent for the comptometer clerks when the noise level was lowered. In a submarine there are many tasks more exacting than either of these and errors may be much more costly. Therefore, sound reduction assumes vital importance. The relationship between lowered efficiency and the production of fatigue by noise was amply demonstrated by Laird (6) where he showed an almost directly proportional relationship between the lowering of output and the increase in the loudness of the noise of the surroundings. General body fatigue is definitely increased by exposure to loud noises. There are other factors definitely connected with the problem of noise in a submarine which, while not within the scope of this paper are of unquestionable military significance; for example, the added protection against detection by sound devices.

In quieting the Diesel engines in submarines, weight, space, and cost are factors of such importance as may make such a procedure impractical or impossible. However, even though complete quieting was not accomplished, any reduction of noise would be splendidly worthwhile.

Ear defenders, such as are manufactured by the Mine Safety Appliance Co. and others are suggested as an alternative. These ear defenders are cheap and produce marked attenuation of noise (about 30 decibels) according to personal correspondence received from Vern O. Knudsen, without reducing the fidelity and provide

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the necessary protection for the delicate mechanism of the ear from the trauma induced by the noise of Diesel engines operating in confined space.

SUMMARY

A technical introduction to a series of papers involving hearing losses due to exposure to various naval hazards has been presented.

Data have been presented illustrating the acute loss of hearing caused by exposure to Diesel engine noise.

Data have also been presented showing that this damage tends to accumulate and become permanent in those being constantly exposed over a period of years.

It has been pointed out that such hearing losses are to the detriment of the best interests of the Service.

The desirability of quieting the engines is suggested.

The wearing of ear defenders is advocated if quieting the engines is deemed impractical.

Further studies concerning naval hazards to hearing are in progress and will be presented as the work progresses.

(To be Continued)

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SILICOSIS AMONG NAVAL FOUNDRYMEN

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INTRODUCTION

The main plan of the present study was a medical survey of the industrial personnel of the steel and the nonferrous foundries of the Naval Gun Factory of the Navy Yard, Washington, D. C., in order to ascertain the possible incidence of silicosis and tuberculosis. The principal objectives were: (1) to determine whether additional protective measures against silicosis were indicated in the foundries, (2) to remove men with silicosis from further harmful exposure, and (3) to

establish which cases, if any, were so disabled as to warrant special investigation for a status of compensation.

It may be of interest to note that the Naval Gun Factory of Washington is an establishment of the Navy for the production of naval ordnance. In normal peacetime all naval guns are manufactured in this plant with the exception that units exceeding the 8-inch class are forged in commercial steel plants, although finished at the naval factory. Under the present conditions of rapid naval expansion the activities of the Naval Gun Factory are naturally accelerating at a high rate.

The two foundries of the Naval Gun Factory—i. e., one of steel and one of nonferrous type are the largest in the naval industrial establishment. These plants are of the miscellaneous, not the productive type. At the time of this survey—i. e., in February 1939—the steel foundry employed approximately 311 men; the nonferrous foundry 176 men, or a total for both of 487, inclusive of supervisory, clerical, and laboratory personnel. At the present time this is a much larger group.

PROCEDURE AND SCOPE OF THE STUDY

The scope of the study consisted of a medical survey of the available mechanical personnel of the two foundries totalling 463 men. Of this group 454 examinations were satisfactorily completed and the study is therefore based on that number.

The procedure consisted of a detailed occupational history, a questionnaire as to present complaints, and a complete clinical examination of the lungs and circulatory system inclusive of a radiograph of the lungs. An individual case record form was mimeographed for the convenient recording of all data.

The examinee was stripped to the waist, and the clinical examination of the heart and lungs conducted, followed by the recording of the blood pressure. Each worker was subjected to an exercise test in which one foot was placed upon a chair and the body raised to an erect position 25 times in 30 seconds. Pulse and respiration rates were taken before, immediately after, and again 2 minutes following the exercise as an indication of disability as reflected in the cardiac and respiratory response. The test was omitted, if considered inadvisable, as the result of concurrent disability.

DISTRIBUTION OF THE FOUNDRY WORKERS BY OCCUPATIONAL RATING

TABLE 1

Occupation	Total workers examined		Occupation	Total workers examined	
	Number	Percentage		Number	Percentage
Molder	163	35.2	Cranemen, electric	22	4.7
Helper, molder	108	23.3	Melters	16	3.5
Molder, apprentices	10	2.2	Sandblasters	12	2.6
Helper, general	43	9.3	Miscellaneous	26	5.6
Chipper	41	8.9			
Laborer, common	22	4.7	Total	463	100.0

The small miscellaneous group includes electric welders, boiler-makers, furnacemen, open hearth melters, ladlemen, machinists, oilers, and cupola tenders.

Note that molders and molder helpers combined make up 58.5 percent of the total; helpers, general, and chippers 18.2 percent; laborers, common, and cranemen, electric 9.4 percent; melters and sandblasters 6.1 percent; and the miscellaneous group 5.6 percent.

DISTRIBUTION OF THE FOUNDRY WORKERS BY AGE GROUPS

TABLE 2

Age groups	Number	Percent	Age groups	Number	Percent
20 to 24	6	1.3	50 to 54	73	15.5
25 to 29	50	10.6	55 to 59	44	9.3
30 to 34	56	11.9	60 and over	19	4.0
35 to 39	64	13.5			
40 to 44	77	16.3	Total	472	100.0
45 to 49	83	17.5			

The personnel is distributed by 5-year periods in 9 age groups. Note that only 1.3 percent were under 25 years; 22.5 percent were in the 25 to 34 age period; 29.8 percent in the 35- to 44-year period; 33 percent in the 45 to 54 group and 13.3 percent over age 54. Presenting this grouping in another manner it is found that 52.3 percent were in the 25–44 age group, 33 percent in the 45–54 period and 13.3 percent above 54.

DISTRIBUTION OF FOUNDRY WORKERS BY DURATION OF DUST EXPOSURE

The distribution of the foundry workers according to duration of employment in the present foundry, in all foundries and in all dusty industries, is listed in table 3.

TABLE 3

Duration of employment years	Present foundry		All foundries		All silicious industries	
	Number	Percent	Number	Percent	Number	Percent
Less than 2	31	6.7	26	5.6	21	4.5
2 to 4	32	6.9	24	5.2	27	5.8
5 to 9	275	59.5	130	28.1	116	25.1
10 to 14	65	14.0	72	15.6	75	16.2
15 to 19	27	5.8	47	10.2	56	12.1
20 to 24	19	4.1	41	9.0	40	8.6
25 to 29	6	1.3	35	7.6	40	8.6
30 to 34	5	1.1	40	8.7	40	8.6
35 to 39	2	.4	32	7.0	32	7.0
40 and over	0	.0	15	3.2	15	3.2
Total	462	100.0	462	100.0	462	100.0

Note. One additional case, which is not included in this table, was credited with a total of 17 years dust exposure, but the period in present and previous foundries was not obtained.

It is evident from this table that many men were employed in their present foundry for relatively shorter periods than was their total employment in the foundry industry. For example 130 men or 28.1 percent of all the foundry workers had a total foundry experience of 5 to 9 years whereas a larger number, 275 or 59.5 percent, had been employed in their present foundry for the same period. It follows that 145 men—i. e., the difference between 275 and 130—had previous employment in other foundries than the one in which they were carried on the rolls at the time of this survey. These workers, therefore, had other dust exposures which may have had some contributory effect on their present pulmonary condition.

It should be emphasized, therefore, that in evaluating the occupational exposure of these foundrymen, not only the period of present foundry employment should be taken into account but, in addition, the total foundry exposure. In fact, it might be more accurate to express this in terms of their total exposure in all siliceous industries, but this approaches so closely to their total foundry employment that it would be a minor refinement.

Present foundry.—The largest occupational duration group was at the 5- to 9-year period; i. e., 275 men or 59.5 percent of the total. The next group in order was at the 10- to 14-year period or 14 percent. Twelve and seven-tenths percent fell in the occupational groups above the 10- to 14-year period. It will be noted that 73.5 percent of the personnel were contained in the 5- to 9- and 10- to 14-year exposure periods.

All foundries.—Of the 462 men it was revealed that 316 or 68.6 percent had received previous foundry experience. The largest occupational duration group again was at the 5- to 9-year period; that is, 130 or 28.1 percent. The next group in order was 72 or 15.6 percent at the 10- to 14-year period. Forty-three and seven-tenths percent of the workers fell in these 2 duration groups. The interesting fact emerges that 34.8 percent of the workers were employed in the foundry industry for a period of 10 to 24 years and 45.7 percent in the groups ranging from 14 to 40 years and over.

X-RAY FINDINGS

The x-ray interpretations were recorded in accordance with the scheme recently adopted by the United States Public Health Service as described by Flinn and his associates (1). The data are presented in table 4.

TABLE 4.—Lung markings

Total dust exposure years	A		B		C		D	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Less than 2	16	80.0	4	20.0	0	.0	0	.0
2 to 4	24	88.8	3	11.2	0	.0	0	.0
5 to 9	96	84.2	16	14.0	2	1.7	0	.0
10 to 14	50	68.5	16	22.0	6	8.2	1	1.3
15 to 19	36	65.5	15	27.3	2	3.7	1	1.8
20 to 24	20	50.0	12	30.0	6	15.0	2	5.0
25 to 29	18	45.0	9	22.5	10	25.0	3	7.5
30 to 34	13	33.3	14	35.9	8	20.5	3	7.7
35 to 39	6	19.0	18	50.0	6	19.0	2	6.2
40 or over	4	28.5	2	14.1	5	35.9	3	21.3
Total	283	62.3	109	24.0	45	9.9	15	3.30

Total dust exposure years	E		F		G		Total
	Number	Percent	Number	Percent	Number	Percent	
Less than 2	0	.0	0	.0	0	.0	20
2 to 4	0	.0	0	.0	0	.0	27
5 to 9	0	.0	0	.0	0	.0	114
10 to 14	0	.0	0	.0	0	.0	73
15 to 19	1	1.8	0	.0	0	.0	55
20 to 24	0	.0	0	.0	0	.0	40
25 to 29	0	.0	0	.0	0	.0	40
30 to 34	1	2.6	0	.0	0	.0	39
35 to 39	0	.0	0	.0	0	.0	32
40 or over	0	.0	0	.0	0	.0	14
Total	2	0.4	0	.0	0	.0	454

The key letters in the table are defined as follows:

A: Normal lung markings and first degree exaggeration of linear pulmonic markings.

B: Second degree exaggeration of linear pulmonic markings.

C: First degree diffuse ground glass appearance not obliterating linear markings, presenting fine discrete nodules stereoscopically and pathologically.

D: Second degree diffuse ground glass appearance obliterating linear markings, presenting fine discrete nodules stereoscopically and pathologically.

E: First degree disseminated nodules up to the size of military tubercles.

F: Second degree disseminated nodules exceeding 1 mm. in size; emphysema usually present.

G: Coalescent nodules and conglomerate shadows.

A and B represent the range of markings usually seen on x-ray examinations of persons who have never had occupational dust exposures; C and D are the earliest markings in the sequence of dust-induced changes which can be clearly differentiated from the changes that usually accompany age, bronchitis, cardiac stasis, etc.; E and F are consistent with stage 1 and stage 2 silicosis according to history, signs and symptoms, although early stage 1 silicosis may fall under D. G is consistent with stage 2 or stage 3 silicosis depending on history, signs, symptoms, and disability.

In accordance with expectancy all cases with less than 5 years' silica dust exposure fell under the A and B categories. The first to appear

in the "C" column was the 5- to 9-year group with two cases or 1.7 percent; the maximum being 35.9 percent for the 40 or over year group. The range in the "D" column began with the 10 to 14 year group at 1.3 percent with the maximum of 21.3 percent for the 40 or over year group. Two cases were reported under category E and none under F and G. It should be pointed out that any comparisons between the data for these various exposure period groups, either in the same or different columns, are subject to the errors of random sampling in view of the relatively small samples involved.

Summing up, it will be noted that 86.3 percent of all cases fell in the A and B categories; that is, showed normal lung markings or first and second degree exaggeration of linear markings; 13.2 percent were in the C and D categories or the earliest indications of dust-induced pulmonary changes; and 0.4 percent in the E category.

SUMMARY OF SILICOSIS CASES

TABLE 5

Case No.	Occupation	Dust expo- sure years	Age	Type of foundry	Silicosis		Symptoms
					Type I	Type II	
53	Sandblaster........	15	42	Mixed..........	0	1	Cough with moderate sputum 1 year.
69	.....do.............	12	43	.....do..........	1	0	Frequent dry cough.
72	.....do.............	21	46	Steel...........	1	0	Slight loss of weight, dyspnea.
168	Foundry chip......	34	56	.....do..........	1	0	None.
357	Molder	41	59	.....do..........	1	0	Moderate dyspnea 1 year.
382	.....do.............	22	56	Nonferrous.....	1	0	None.
407	.....do.............	36	54	.....do..........	1	0	Do.
408	.....do.............	30	53	Mixed..........	1	0	Do.
422	.....do.............	31	46	Steel...........	1	0	Do.
440	.....do.............	25	47	Mixed..........	1	0	Do.
456	.....do.............	29	44	.....do..........	1	0	Do.

Note.—No. 72 had 10 years foundry and 11 years coal mine exposure.

Eleven cases of silicosis were reported by x-ray, 1 as stage 2 and 10 as stage 1; 9 cases of stage 1 being classified under category D, one of stage 1, and 1 of stage 2 under E.

Four of the cases presented symptoms referable to the chest; in two dyspnea appeared sufficiently pronounced to contraindicate the exercise test. Four of the cases had a history of exclusive steel foundry service, two of nonferrous foundry employment, and five mixed. There were three occupational groups involved, i. e., sandblasters, foundry chippers and molders; the last named making up 63.3 percent of the total. Seven of the cases alleged no symptoms and the physical examination and exercise tests were negative. It may be stated that none of the group had developed any apparent occupational disability.

It may appear surprising that no cases of silicosis were found among the shake-out personnel who are ordinarily exposed to the heaviest dust concentrations in the foundry. This is in all probability

accounted for by the relatively short dust exposure periods of this common laborer group which ranged from 2 to 13 years with an average of only 6.6 years. Not even a borderline case of silicosis fell in this group.

Greenburg, Siegel, and Smith (2) conducted an x-ray study of 4,066 foundrymen in New York State in 1938 distributed through 80 plants. They reported an incidence of all types of silicosis of 2.7 percent; 2.3 percent of first stage, 0.4 percent of second stage and 0.1 percent of third stage type. In the present survey the total incidence was 2.4 percent with 2 2 percent of first stage, 0.2 percent of second stage and none of the third stage type; a comparatively low incidence, but due reservation is indicated in view of the relatively small group involved.

An important consideration is the factor of silica dust exposure prior to employment in the present foundry and probably contributing to the present silicotic condition of these cases. In one instance, No. 168, all exposure, totaling 34 years, had taken place in the present foundry; in seven of the remaining instances the duration of prior foundry exposure was considerably longer than the present employment. The silicosis, therefore, in these cases cannot necessarily be attributed to present or previous environmental conditions in the naval gun factory foundries.

9. BORDERLINE CASES OF SILICOSIS

TABLE 6

Case No.	Occupation	Dust exposure years	Age	Type of foundry	Symptoms
46	Foundry chip	10	59	Steel	Chronic cough; productive.
70	Boilermaker	25	55	do	None.
79	Furnaceman	25	61	Nonferrous	Weakness; variable chest 13 years.
172	Helper molder	11	31	Steel	None.
326	Molder	29	58	do	Slight dyspnea.
358	do	45	61	do	Dyspnea.
359	do	40	54	do	None.
360	do	36	50	do	Dyspnea.
364	do	38	57	Mixed	None.
367	do	25	44	Nonferrous	Do.
371	do	34	49	do	Do.
373	do	26	55	Steel	Do.
375	do	39	64	Nonferrous	Do.
387	do	26	57	do	Do.
402	do	31	47	do	Do.
411	do	40	59	Steel	Do.
462	do	10	37	do	Do.

These 17 cases were interpreted by x-ray as of the borderline or presilicotic type, that is, not definitely as silicosis but with lung markings indicative of an initial trend thereto. Three cases were classified under category D, 13 cases under C, and 1 under B. The incidence of borderline cases was 3.7 percent. It will be noted that of the 5 occupations involved 76.5 percent were molders. In only 5 instances

were symptoms reported of respiratory nature. It is believed that al workers in a borderline category should be x-rayed annually as a check upon the possible progression of the condition.

SUMMARY OF CASES OF TUBERCULOSIS BY X-RAY

TABLE 7

Case No.	Occupation	Dust exposure years	Age	Type of foundry	Interpretation
27	Foundry chipper___	7.5	52	Nonferrous_____	Arrested adult TB.
77	Laborer common___	7.5	55	Mixed_____	Predominantly infective moderately advanced TB; questionable activity.
99	Foundry chipper___	15.0	(*)	Nonferrous_____	Arrested adult TB.
102	Helper molder_____	7.0	34	Steel_____	Healed reinfection TB.
171	____do_____	9.0	47	Nonferrous_____	Moderately advanced TB; probably active.
220	____do_____	7.0	47	Mixed_____	Consistent with moderately advanced TB.
238	____do_____	16.0	64	Steel_____	Predominantly infective; probably moderately advanced TB.
396	Molder_____	37.0	50	Nonferrous_____	Consistent with fibroid TB.
410	____do_____	34.0	(*)	Steel_____	Consistent with active TB.
430	____do_____	36.0	55	____do_____	Arrested adult TB.
441	____do_____	31.0	56	____do_____	Healing TB; moderately advanced.

*Age unknown.

It should be stressed that a diagnosis of tuberculosis requires confirmative evidence in the form of findings from clinical and sputum examination in addition to the x-ray of the chest. In this survey, the chest examinations were necessarily superficial and the men were not available for sputum specimens at the time. Reliance, therefore, has been chiefly placed on the x-ray interpretations. Additional study would have been essential in order to determine conclusively which cases, if any, were in the active stage. With these reservations the x-ray data are presented.

Three of the total of 11 cases were interpreted by x-ray as arrested, 1 as a healed reinfection type, 1 as fibroid, 5 as consistent with a moderately advanced stage and 1 as merely consistent with active tuberculosis. Case 171 has subsequently been definitely diagnosed as active and retired from employment. The total incidence of tuberculosis by x-ray based on the 454 examined was 2.4 percent, 1.1 percent being consistent with possible clinical activity and 1.3 percent as of healed or arrested reinfection type.

A comparison with the x-ray study of foundrymen by Greenburg, Siegel, and Smith (2) based on 4,066 men, already referred to, is of interest. They reported 12.8 percent of healed primary and reinfection type and 1 percent as clinically significant. In our series based on 454 men the analogous figures are 5.7 percent and 1.1 percent. Twenty cases of healed primary type were reported, or 4.4 percent; these not being tabulated.

None of the tuberculosis cases in the present group were complicated by silicosis, that is, no silico-tuberculosis types were found. It appears to be established that prolonged inhalation of free silica dust predisposes to tuberculosis even though unassociated with silicosis. The tuberculosis cases were distributed between foundry chippers, molders, helper molders, and common laborers.

RELATION OF DURATION OF DUST EXPOSURE TO SILICOSIS AND TUBERCULOSIS

TABLE 8

Duration of dust exposure years	Number	Percent of total	Silicosis		Borderline		Tuberculosis	
			Number	Percent	Number	Percent	Number	Percent
Less than 2	20	4.4	0	0.0	0	0.0	0	0.0
2 to 4	27	5.9	0	.0	0	.0	0	.0
5 to 9	114	25.1	0	.0	0	.0	5	4.4
10 to 14	73	16.1	1	1.3	3	4.1	0	.0
15 to 19	55	12.1	1	1.8	0	.0	2	3.4
20 to 24	40	8.8	2	5.0	0	.0	0	.0
25 to 29	40	8.8	2	5.0	6	15.0	0	.0
30 to 34	39	8.6	3	7.7	2	5.1	2	5.1
35 to 39	32	7.0	1	3.1	3	9.4	2	6.2
40 or over	14	3.1	1	7.1	3	21.4	0	.0
Total	454	100.0	11	2.4	17	3.7	11	2.4

Note that silicosis was not reported prior to the 10- to 14-year exposure period. The percentage incidence showed, in general, an increasing trend with progressively longer dust exposure periods. Sixty-four and six-tenths percent of the foundrymen were contained in the exposure periods of 10 to 14 years and above. Of the 11 cases of silicosis, 1 occurred in the 10 to 14 occupational duration group, 1 in the 15 to 19 group, 2 in the 20 to 24 group, 2 in the 25- to 29-year group, 3 in the 30- to 34-year group, 1 in the 35- to 39-year group, and 1 in the group of 40 or over.

The minimum period of dust exposure for the borderline silicosis group was 10 years, the maximum 40 years. Of the 17 cases 14 or 82.3 percent occurred in the occupational duration groups of 25 to 29 years and above. In three instances only was there a record of less than 25 years service.

Of the 11 cases listed as tuberculosis, 5 were in the 5- to 9-year occupational group, 2 in the 30- to 34-year bracket, and 2 in the 35- to 39-year period.

SILICA DUST CONCENTRATIONS

Silica dust concentrations were not determined in the present study but an engineering survey of the Steel Foundry of the Naval Gun Factory was conducted by DellaValle of the United States Public

Health Service in 1934 (3). Dust counts were made at that time for various occupational groups at the breathing level. These ranged from 4.9 to 25.1, M. P. P. C. F.[1] with an average of 14.2 M. P. P. C. F.; this not including the count of approximately 300 M. P. P. C. F. for shake-out operations during the night shift.

Hatch, Williams, and Dolin (4) conducted a survey of dust concentrations in 12 New York State foundries in 1939 and their findings are significant in this connection. They pointed out that a quantitative relation between dust exposure and pulmonary damage is difficult to demonstrate because of the many other complicating factors, such as length of exposure, composition of the mixed dust and average size of the particles. Their studies indicated that all dust exposure in foundries can be reduced with reasonable control to 30 M. P. P. C. F., and that the average count can be kept at 15 M. P. P. C. F. They concluded, predicated upon the results of medical studies in the foundry industry, that silicosis can be prevented if the average dust concentration is limited to 15 M. P. P. C. F.

The dust concentrations of the steel foundry as found by DellaValle in 1934 may therefore be considered as comparatively low but, as he emphasized, the samples were collected under summer season conditions when general ventilation is most effective.

A number of recommendations were made at the time to the end of improved dust control, the chief measure proposed being the erection of a separate casting cleaning shop. The enormously increased activity of operations in these foundries incident to the present naval expansion has tended in all probability to increase silica dust concentrations. It has, therefore, been advised that a complete engineering hygiene survey of both foundries be conducted with the object of ascertaining the efficiency of present dust control methods.

SUMMARY

1. The findings of a medical survey of 454 employees of the steel and nonferrous foundries of the Naval Gun Factory, Navy Yard, Washington, D. C., were reported based on the occupational history, clinical examination of the lungs and heart and radiographs of the chest.

2. The occupational distribution was as follows: molders and molder helpers 58.5 percent; helpers, general, and chippers 18.2 percent; laborers, common, and electric cranemen 9.4 percent; melters and sandblasters 6.1 percent; miscellaneous 5.6 percent.

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[1] Million parts per cubic foot.

3. Distribution by total duration of silica dust exposure: 68.6 percent had been exposed in other foundries prior to the present employment; 43.7 percent were in the 5- to 9- and 10- to 14-year duration exposure groups, and 45.7 percent in the groups ranging from 14 years to 40 years and over.

4. X-ray findings: the United States Public Health Service classification was utilized. Eighty-six and three-tenths percent of the cases fell in categories A and B, that is, with normal lung markings or first- and second-degree exaggeration of linear pulmonic markings. Thirteen and two-tenths percent fell in categories C and D or the earliest indications of dust induced pulmonary changes with fine discrete nodules stereoscopically and pathologically. Four-tenths percent were in category E characterized by first-degree disseminated nodules up to the size of miliary tubercles. None were found in categories F or G.

5. Eleven silicosis cases were reported by x-ray, 10 first stage and 1 second stage; one case occurring in 10- to 14-year exposure group as the shortest and 1 in the 40-year and over group as the longest period of dust exposure. The incidence was 2.4 percent.

6. Seventeen borderline cases were reported by x-ray or an incidence of 3.7 percent; 82.3 of these falling in the occupational duration group of 25 to 29 years or above.

7. The incidence of tuberculosis by x-ray was 2.4 percent or 11 cases; 1.1 percent being consistent with possible clinical activity and 1.3 percent as of healed or arrested reinfection type.

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THE IMPORTANT ANAEROBIC INFECTIONS AND THE USE OF ZINC PEROXIDE IN THEIR CONTROL

By Frank L. Meleney, M. D.

THE ANAEROBIC ORGANISMS WHICH PRODUCE HUMAN INFECTIONS

The first World War, 1914 to 1918, called to our attention the importance of anaerobic organisms in war wounds. The highly cultivated soil of France and the unhygienic condition of trench warfare resulted in a heavy contamination of all types of war wounds with these organisms and the introduction of high exposives with their destructive effects on human tissues made fertile fields in which these bacteria found conditions favorable for their development and metabolic activities.

During those years, however, lack of general knowledge of anaerobic organisms and the limited facilities of laboratory service in the front line hospitals made it impossible to work out any solution of the problem of anaerobic infections or even any clarification of the problem itself.

Pasteur (1) had noted in the eighteen seventies that there were organisms which would not grow in the presence of free air and he called these organisms anaerobes. He found a pathogenic anaerobe in a fatal infection in a cow and described its cultural characteristics. He called this organism *Vibrion septique*. We now know that this is one of the organisms of the gas gangrene group, which is pathogenic for man and which we now call *Clostridium septicum*.

It was not until 1892, that the commonest of gas gangrene organisms was found and described by Welch (2). He called it *Bacillus aerogenes capsulatus* but it is now called *Clostridium welchii* in his honor.

During the World War a great many cases of gas gangrene were observed in military hospitals and independent investigators attempted to isolate the anaerobic organisms and appraise their importance in these infections. With a great many investigators working independently on the same problem it was not surprising that different names were given to the same species by different workers. Furthermore, they often ascribed different cultural characteristics to the same species due to the fact that standard methods of anaerobic technic had not been worked out.

Another difficulty lay in the fact that these infections were almost invariably polymicrobic, containing numerous species both aerobic and anaerobic, so that in many cases cultures were impure and cultural properties were ascribed to certain species which were due to the contaminants. Such mixed cultures were often transferred from one laboratory to another for purposes of study. Quite naturally, different

results were obtained in different laboratories by different investigators for what seemed to be the same culture. This resulted in a chaotic condition of our knowledge with regard to anaerobes which could not be clarified during the stress and strain of war.

After the armistice, however, an attempt was made to bring order out of chaos by investigators both in Europe and America. This was carried out systematically by Bulloch and his collaborators (3) in England, and by Hall (4) in this country, and by Weinberg (5) in France. These systematic studies have clarified the problem by isolating pure strains of anaerobes and determining their cultural characteristics and pathogenic power.

With regard to the gas gangrene organisms, it is now known that there are four well established Gram positive spore-forming anaerobic bacilli, which produce powerful exotoxins and which can produce the typical lesions of gas gangrene in animals in pure culture. These are *Clostridium welchii*, *Clostridium novyi*, *Clostridium septicum*, and *Clostridium sordellii*. Besides these organims there is another important clostridium which produces the typical symptoms and lesions of tetanus, *Clostridium tetani*. Furthermore, there are certain borderline clostridia which are not pathogenic for man but are pathogenic for animals. These include *Clostridium histolyticum*, *Clostridium chauvei* and some strains of *Clostridium sporogenes*. Besides these there are many other Clostridia which were found in gas gangrene cases, which cannot be shown to be pathogenic for animals and are thought to be of secondary importance in human infections.

It was recognized that there were also anaerobic cocci and anaerobic Gram negative nonspore-forming bacilli, which were frequently found in these infections but for the most part their pathogenicity could not be demonstrated and their importance is only now beginning to be recognized. Schottmüller (6) was among the first to describe a puerperal infection due to an anaerobic streptococcus. Prevot (7) and also Colebrook and Hare (8) have attempted to classify the anaerobic streptococci but they need further study. The nonspore-forming anaerobic rods both Gram positive and Gram negative have had still less attention. However, fatal cases have been reported by Dixon and Deuterman (9) and Thompson and Beaver (10), and Heyde (11) has emphasized the importance of these organisms in peritonitis. Dack and Dragstedt (12) consider the Gram negative anaerobic nonspore-forming rod, *Bacterium necrophorum* of significance in ulcerative colitis and the author has found it not infrequently in other lesions (13).

For the most part, the studies which have been made on anaerobic organisms have concerned themselves with the cultural characteristics of pure strains. The synergistic or antagonistic properties of these

organisms have received practically no attention. It is well recognized, however, that in human cases these infections are almost always mixed, so that the relationship of one species to another within a wound may be of considerable importance. It has been demonstrated that certain organisms favor the growth and metabolic activities of other species living in the same surroundings, while they are antagonistic to other species.

It has also been demonstrated that in the development of certain pathological processes by mixed cultures one species can initiate the inflammatory reactions in the host and the other can complete them. Such a process has been demonstrated in the progressive bacterial synergistic gangrene of the abdominal or chest wall (14). This same initiation and completion of chemical changes has also been demonstrated in the test tube by the action of two different strains of organisms. A common illustration of this effect is the action of yeast on bread. Certain of the yeasts can only act in synergism with certain streptococci. After the cocci have produced an acid in the dough the yeast goes on to produce gas, which raises the dough (15).

Since 1925, the author has been particularly interested in this problem of anaerobic infections and in the surgical department of the Presbyterian Hospital in New York all unusual infections have been studied with anaerobic as well as aerobic bacteriological technic. This routine study has brought to light a number of obscure anaerobic infections and has demonstrated the importance of the anaerobic organisms in a large number of different kinds of surgical infections. It has also brought to light the etiological factors in a number of hitherto obscure conditions. Besides the anaerobic organisms the microaerophilic bacteria have been studied and have been found to be of considerable importance in certain chronic ulcerative conditions (16) and in many of the mixed infections commonly found along the alimentary tract.

THE LESIONS CAUSED BY ANAEROBIC ORGANISMS

The alimentary tract of man and animals is the chief source of anaerobic organisms so that man is constantly subject to invasion with these bacterial forms. Any injury to or ulceration of the mucous membrane of the alimentary tract from the mouth to the anus will open the door for the entrance of these organisms. When the skin is broken the contaminating anaerobes may come either from the patient's own alimentary tract or from that of animals. Compound fractures are frequently so contaminated because they are often received as a result of street accidents or country road injuries with dirt and manure ground into them. Often they are directly contaminated by fertilized soil. Compound fractures are almost always associated

with damage to muscle in which the anaerobic clostridia grow abundantly. Thorough debridement is most difficult and attempt at reduction, with a realignment of the bones, almost invariably shuts off little pockets, or metal plates retain the organisms beneath them, or screws carry them into the bone.[1]

Soft part injuries on the surface may be similarly contaminated but they are usually more superficial, muscle may not be damaged or exposed, foreign bodies are not so often introduced, they are more easily debrided or cleaned and no compromise need be made with infection by closing the wound.

Particular care must be taken with wounds of the hands in which the cutting and retraction of muscles or tendons after they have been on the stretch, as in a clenched fist, may carry the organisms into the depths where anaerobes like to grow. If the clenched fist has been cut by an intended victim's teeth, the mouth organisms are transferred directly from one human environment to a similar environment and no adaptation is needed before they start to grow.

The most comon anaerobic infections are of course, dental in origin. The chronic ulcers of the mouth with or without the spirilla and spirochaetes of Vincent almost always have their basic etiology in the anaerobic streptococci of the mouth. When these organisms have an opportunity to invade the mucous membrane around the teeth they are very prone to get down to the apices. They may then spread through lymphatics to the lymph glands or directly through the tissues. This happens most frequently after extraction when the surrounding tissues are damaged and the tooth socket is then packed, thus retaining the anaerobes in damaged tissue. The mixed cultures of these organisms massively destroy tissue, not infrequently spreading into the jaw bones, the face, or the neck where the infection may close the glottis or enter the mediastinum.

Mediastinal infections frequently result from the entrance of anaerobes through the esophageal wall following a perforation by a foreign body, or through a caustic or neoplastic ulcer. Occasionally the trauma of passing an esophagoscope or the taking of a biopsy opens the door for the entrance of the organisms. When they invade they almost always spread slowly but uncontrollably destroying tissue massively until the fatal outcome.

Farther down the alimentary tract the anaerobes are heard from most frequently following a perforation of the appendix or the gut due to a diverticulitis, a malignant ulcer or a foreign body, but in the

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[1] The author has just seen, on the day of this writing, a case of compound fracture of tibia and fibula, which had been debrided, the bone pinned, the wound filled with sulfanilamide and the leg put up in a cast. This developed an anaerobic hemolytic streptococcus infection which required a midthigh amputation. The stump then became infected with the same organism in spite of general sulfonamide therapy.

peritoneal cavity they do not play the destructive role that they do in soft tissues elsewhere. It is true that they have a synergistic action with the colon bacillus but the peritoneum seems to be able to check their destructive action as the soft parts of the abdominal wall can not. And so more frequently we have a spread of anaerobes in the abdominal wall following the drainage of an intraperitoneal infection, than we have a spread within the peritoneal cavity. This usually results in a foul-smelling local sloughing of the fascial tissues, but sometimes takes the form of a rapidly spreading gas gangrene, or the chronic progressive undermining ulceration of the skin, or the slowly spreading synergistic gangrene.

A common site of anaerobic activity is at the very end of the alimentary tract around the rectum and anus. As the stool becomes dehydrated and the hard particles scrape against the wall during evacuation, the mucous membrane is frequently injured and the organisms are given an opportunity to invade the deeper tissues. Such injury probably happens with almost every passage of a constipated stool so that the tissues must have some local defense which prevents infections from invariably occurring. It usually is a local process and is readily approachable and only rarely spreads extensively either into the pelvis or in the buttocks.[2]

The mouth anaerobes not infrequently get down into the lungs by the accidental aspiration of foreign bodies, or mucus, or food, or due to the entrance of blood or bits of tissue during operations on the tonsils under anesthesia. The cough reflex usually prevents this when it is in working order but when it is lost these organisms readily find access and may produce an infection yielding occasionally pure, but usually mixed cultures. These infections frequently become lung abscesses which may remain localized or spread into the pleura producing a putrid empyema.

Chronic ulcerations of the surface of the body or the mucous membranes from other causes, particularly malignant ulcers or circulatory lesions such as gangrenous extremities, may be secondarily infected with anaerobic bacteria, which find such damaged tissues a favorable environment in which to grow. Cancerous lesions of the mouth are particularly vulnerable to infection with these organisms (17). Epitheliomas of the skin, especially around the anus or buttocks, are next most frequently similarly affected. Less frequently perhaps ulcerating carcinomas of the breast are invaded by anaerobes. The infection of gangrenous lower extremities with anaerobes should always be kept

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[2] The author has recently seen a case with multiple ramifications and tracts around the anus from which the *Clostridium welchii*, the chief gas gangrene organism, was found in pure culture, and another case with undermining and burrowing of all of the skin of both buttocks, of 4 years' duration, due to the microaerophilic hemolytic streptococcus.

in mind when amputation is being considered. It is all too often forgotten and infection of amputation stumps not infrequently occurs (18).

Anaerobic infections are usually, although not invariably, foul-smelling. When there is a foul odor one may be almost certain that anerobic streptococci are playing an important role. This odor is often erroneously attributed to the *Bacillus coli* which has little if any odor. The gas gangrene group of organisms produce a character-can therefore be fairly certain that if the odor is foul, the anaerobes streptococci are associated with the *Clostridia* in the infection. One can therefore be fairly certain that if the odor is foul the anaerobes are active but if the odor is not foul their presence cannot be ruled out. The only important aerobe that produces a bad odor is *Bacillus proteus* and this is frequently associated with the anaerobes. *Bacillus pyocyaneus* yields an unpleasant but not a foul odor and the green pigment always indicates its presence.   `

THE TREATMENT OF ANAEROBIC INFECTIONS

Anaerobic infections are essentially local and are generally amenable to local treatment. It is true that the gas gangrene organisms may spread rapidly but they do not often invade the blood stream until just before or just after death, nor do they often set up foci in other parts of the body as do the aerobic streptococci and staphylococci. The gas gangrene organisms and tetanus produce toxins, especially when growing in muscle tissue. The toxins circulate around the body and in the case of tetanus toxin attack the central nervous tissues but the organisms stay at or near the portal of entry. The essential principles in treatment are the complete removal of the toxin manufacturing plant, the prevention of further local spread and the neutralization of the circulating toxin by specific antitoxin. With the less rapidly spreading anaerobic infections the local excision may be less radical but the focus must be widely opened for exposure to effective local medication.

One attribute, which all anaerobic organisms have in common, is their inability to multiply or even live in an environment rich in oxygen or with a high oxidation-reduction potential. In the test tube it has been shown that all of them succumb after a few hours' contact with an agent which can continuously generate oxygen, even in very low concentrations. The spores are more resistant than the vegetative forms but these too succumb with higher concentrations of the agent. In fact the more anaerobic the requirements are for growth, the more susceptible are the organisms to the oxidizing action of the agent (19). Furthermore, clinical experience has shown that if contact can be obtained between the infected surface and this medication, the activity of these organisms ceases and they then disappear from the lesion.

During the first World War efforts were made to combat gas gangrene infections by the use of various local oxidizing agents, including hydrogen peroxide, potassium chlorate, potassium permanganate, sodium perborate and others, but they were not successful because of the evanescent character of their oxidation properties. Even gaseous oxygen was tried but it was ineffective either because the oxygen was not nascent or it could not reach the nooks and crannies of the wound and come in close enough contact with the organisms.

In 1927, it was observed by the author and his coworkers that a certain type of chronic undermining burrowing ulcer of the abdominal wall yielded, on culture a hemolytic streptococcus, which would only grow on the anaerobic plate on primary cultivation, although on subsequent cultivation it could adapt itself to the air and grow aerobically. This classified the organism in the intermediate group between the aerobes and anaerobes, a group which is called microaerophilic—preferring a reduced-oxidation reduction potential in its environment or as Prévot calls it—"anaerobic by predilection." Nothing could be done to stop the progress of this infection and it ended fatally. This organism was later found in two similar cases and in the latter case it was present in pure culture. This patient was observed in 1933. Continuous study of this organism in the laboratory revealed its peculiar susceptibility to oxygen and in an effort to stop the progress of the disease an oxidizing agent was sought for which would liberate oxygen slowly and continuously over a long period of time and one that would not be injurious or toxic to human tissues. Such an agent was found in zinc peroxide. The local application of this white powder suspended in distilled water, halted the progress of the infection in this case and shortly afterward was used successfully in two similar cases. This series served as a basis for a report which appeared in April 1935 (16).

Since that time this medication has been used in the treatment of all types of anaerobic infections wherever they have been found, as described in the second section of this paper, and the successful treatment of anaerobic and microaerophilic infections has been abundantly confirmed by many workers. Furthermore, it has been amply demonstrated that there is no local injury to the tissues or toxicity to the body as a whole. In the last few years numerous favorable reports have appeared in the literature to which reference is herewith made (20).

The successful use of zinc peroxide in the treatment of anaerobic infections depends upon three simple principles which are based upon the knowledge of the way the anaerobic organisms produce an infection and the way zinc peroxide functions to prevent their activities.

FIRST

It must be an active preparation.—It must be capable of liberating oxygen when suspended in water or in contact with body fluids. It was difficult at first for the manufacturers to make a standard uniformly active product, but now it is available in large quantities. This has been accepted by the Council on Pharmacy and Chemistry for admission to the New and Nonofficial Remedies. It may be used as it comes from the distributors without heating, but it may be sterilized and is somewhat more active if heated in convenient quantities in large test tubes in a dry oven at 140° C. for 4 hours. After heating, it will remain active and does not deteriorate for a year or more.

SECOND

It must come in close contact with every part of the infected surface.—This usually requires a preliminary surgical procedure. In slowly spreading chronic infections this may simply mean opening up the infected focus. In rapidly spreading gas gangrene, it means excising all of the grossly involved or damaged tissue. Sometimes infected sinuses may be contacted without wide exposure but unless the anatomical situation requires a compromise, it is better to be on the radical rather than the conservative side of the fence in the operative procedure. When the tissues are exposed, the creamy suspension of the powder in sterile distilled water (or tap water if distilled is not available) is applied with an asepto syringe to all parts of the infected surface. If the consistency is creamy (about 40 percent) it will cling to the surface as an even film. It should not be too watery nor too thick. Then a thin layer of absorbent cotton soaked in the zinc peroxide suspension is laid over the wound surface.

THIRD

It must be kept wet.—Moisture must be present in order that oxygen may be liberated, probably by the intermediate production of hydrogen peroxide—the nascent oxygen passing over by a continuous process through the water from the zinc peroxide to the surrounding tissues. This is readily accomplished by covering the inner thin layer of cotton which is soaked with the zinc peroxide suspension, with a thicker layer of cotton wet with distilled water, overlapping slightly on all margins to prevent exposure if the dressing shifts. This in turn is covered with sheet rubber or oiled silk and then with a towel or bandage to hold down the edges to prevent the escape of moisture. On small dressings the wet cotton may be sealed in by

FIGURE 1.—WOUND SURFACES ARE LAYERED WITH ZINC PEROXIDE SUSPENSION

several layers of fine meshed gauze impregnated with vaseline or zinc oxide ointment which is kinder to the skin over a period of days.

The dressings may be left on for several days and the zinc peroxide will continue to be active, but it is probably better to change the dressings each day to remove exudate and note the progress of wound healing. If any portions of the wound are not doing well because of insufficient contact these areas will be apparent at once. The dressings even with absorbent cotton will not stick to the wound if they have been kept moist but the whole dressing comes off as one plaque or mass. The exudate and particles of zinc peroxide may be readily washed away with an irrigating can of saline. If the part is in a cast, the latter can be kept dry during the irrigating process by alternate washing and suction with a syringe. When the loose particles have been removed, a new coat of zinc peroxide is applied as before with the dressings to cover it as described above.

With the zinc peroxide treatment one is struck by the immediate disappearance of the odor from the wound and the absence or subsidence of all signs of inflammation. The surface of the wound looks gray and inert for the first 3 or 4 days but then granulating points begin to appear. These rapidly fuse, and frequently on the tenth to the fourteenth day it is possible to cover the defect with a skin graft. Tendons or fascia or bone are the slowest to granulate and if these are present in the wound, grafting may be delayed. Cultures should be taken at frequent intervals to be sure the organisms have been killed off, particularly from areas not doing so well as the rest of the wound. Such areas may indicate that proper contact is not being attained and sometimes special attention must be given to be sure of contact. There may be a sinus or an involved lymph gland in such a region. The granulations should be firm and pink, and new skin should be active on the margins and the cultures should be negative for anaerobes before skin grafting is done. If these principles are understood, and these precautions taken, zinc peroxide will invariably give satisfaction in the treatment of anaerobic infections.

The recent advent of the sulfonamides in the treatment of infections has largely eliminated the problem of aerobic hemolytic streptococcus, pneumococcus and gonococcus infections. These infections are characterized by a relatively long primary stage of cellulitis in which there is no destruction of tissue. Their value in other types of infection in which there is early destruction of tissue, has yet to be demonstrated. Both laboratory and clinical evidence is conflicting and equivocal, particularly with regard to infections with the anaerobes.

The prophylactic action of the sulfonamides and zinc peroxide in preventing infection in contaminated accidental wounds, street acci-

dents and war casualties will be subjected to a careful laboratory and clinical study under the direction of the Subcommittee on Surgical Infections of the National Research Council. It is hoped that a proper appraisal of these new chemotherapeutic agents can be obtained within a year.

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EMPLOYMENT OF HELIUM IN DIVING TO NEW DEPTHS OF 440 FEET

By Lieutenant Commander Albert R. Behnke, Jr., Medical Corps, United States Navy

In 1938 End (1) reported a dive made in Lake Michigan to a depth of 420 feet, in which the diver inhaled a mixture of helium and oxygen.

On June 22, 1941 two dives were made to the sunken U. S. S. O-9 at a depth of 440 feet. These dives represent a further advance in the endeavors of the Experimental Diving Unit to increase the scope and depth of underwater activity.

The inhalation of helium-oxygen mixtures made possible the deep diving without injury to personnel. The divers, although they were subjected to a pressure of 14.3 atmospheres or approximately 210 pounds per square inch, felt well at the extreme depth.

Including time of descent, the divers spent 10 minutes on the bottom. The following decompression table provided an ascent from 440 feet to 170 feet in 3 minutes; a 7-minute stop at 170 feet; a 2-minute stop at 120 and at 110 feet respectively; a 3-minute stop at 100 and 90 feet respectively; a 6-minute stop at 80 feet; a 9-minute stop at 70 feet; a 10-minute stop at the 60-foot level where the helium-oxygen mixture was replaced by pure oxygen, and a 10-minute stop at 50 feet.

The divers were then brought to the surface and the decompression was completed by the inhalation of oxygen for a period of 78 minutes at a pressure level equivalent to 50 feet.

DISCUSSION

Effect of pressure.—Extreme hydrostatic pressures in the range of 100 atmospheres, sufficient to decrease fluid volume, injure protoplasm (2). No effects, however, can be attributed to the fluctuations of pressure per se in the range between 16 atmospheres and one-sixth of an atmosphere, provided that the passages to the tympanic and sinal spaces are patent. In diving depths, 16 atmospheres is equivalent to 500 feet, and in altitude ascent, one-sixth of an atmosphere is equivalent to 42,000 feet.

Disturbances in gaseous equilibria, however, accompany any alteration of ambient pressure and bring about the observed responses.

The increased partial pressure of oxygen, although the percentage may exceed 21 or normal at sea level, may be sufficient to induce loss of consciousness at depths of 500 feet. For the O-9 dives in order to avoid toxic injury from oxygen the percentage was decreased to a value of about 12.

Nitrogen narcosis.—The most remarkable phenomenon inherent in an air atmosphere is the narcotic effect of nitrogen tending to render a diver practically helpless at depths in excess of 300 feet.

The substitution of helium for the atmospheric nitrogen enables divers to feel well at depths as great as 500 feet. It is this property of helium that renders it indispensable in deep-sea diving.

As an explanation of the narcotic effect of nitrogen and by contrast the benign influence of helium, it is likely that the fat-water solubility ratios rather than the molecular weights of these gases are significant.

The Meyer-Overton hypothesis postulates that all substances highly soluble in fat as compared with water are potentially narcotic. In accord with this concept it is observed that nitrogen possesses a "partition" coefficient of 5.2 to 1 while the corresponding ratio for helium is 1.7 to 1.

Comparative decompression time for the helium and the air dive.— For short exposures up to 30 minutes duration, decompression time is about the same for both helium and air dives. For long exposures during which the body fat becomes saturated with ambient gas, the decompression time is reduced to about one-third or less for helium compared with air.

Bends, for example, may be considered as originating from bubble formation in bone marrow which contains about 90 percent lipid matter. The lessened incidence of bends following long exposures in compressed helium atmospheres is undoubtedly the result of the comparatively low solubility of helium in fat.

The tendency to spinal cord injury bringing about divers' paralysis likewise should be minimized in the helium atmosphere since spinal cord substance may contain about 27 percent lipid matter.

Surface decompression.—If an opportunity is afforded for the escape of gas dissolved in the blood stream and body fluids by a comparatively slow ascent to the 50-foot level, a diver can then be brought quickly to the surface and decompression completed in a chamber.

When this ideal condition prevails the diver is warm, under observation, and able to rest. The inhalation of oxygen coupled with the pressure of 2.5 atmospheres (50 feet) prevents bubble formation and ensures a maximum elimination of inert gas.

The selection of divers resistant to bends.—Among healthy men there exists a wide variation in their susceptibility to bends. Heretofore a satisfactory test was not available to grade men according to their resistance to decompression symptoms. As a result of rapid decompression to simulated high altitudes it was found that some divers developed bends at altitudes as low as 27,000 feet during one hour exposure. Resistant divers on the other hand were able to ascend to 40,000 feet at the rate of 5,000 feet per minute and to remain at this altitude for a period of 1 hour.

The divers selected to make the 440-foot dives were men who were immune to decompression embolism at the 40,000-foot altitude.

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CALCULUS DISEASE OF THE URINARY TRACT

By Lieutenant Commander F. R. Moore, Medical Corps, United States Navy

Recent developments in the pathogenesis, etiology, treatment, and prevention of recurrences of urinary calculi have begun to lift the veil of secrecy that has so long surrounded calculus disease of the urinary tract.

I would like to present 46 cases of urinary calculi, 10 renal and 36 ureteral, in which most of these recent developments have been applied, particularly stressing the prevention of recurrence.

Most of the larger medical centers are doing excellent work in tracing down the etiological factors and working toward the prevention of recurrence in all cases of urinary calculi. This work has been particularly well organized in the Stone Clinic at the Massachusetts General Hospital which was organized in 1935. The personnel of this clinic consists of one or two urologists, an internist, a physical chemist, a nurse, and a secretary. This clinic is used mainly to follow up cases of urinary lithiasis. These patients receive cystoscopic and x-ray examinations as indicated; also their stones, blood and urinary analyses are thoroughly studied and their diet fully investigated. The results of this careful work is not only a great boon to the patient, but the information derived from these studies goes far toward increasing our knowledge of the formation and prevention of urinary calculi. Excellent work is also being done along this line in the urology departments at the Mayo Clinic, the University of Pennsylvania, University of California, the Cleveland Clinic, the University of Tennessee, and in many other medical groups.

PATHOGENESIS

Randall (et al.) in several papers since 1936 has presented evidence that primary renal calculi originates as a slow crystallization of urinary salts upon a lesion in the renal papillae. He has presented evidence that calcium phosphate, calcium oxalate, and uric-acid crystallization is deposited upon a plaque of calcium salts, deposited in renal papillae to form renal calculi. This work is a result of a careful study of renal papillae in 1,154 autopsies, in which calcium salts were recognized microscopically in the renal papillae in

19.6 percent of the cases. In the same series 5.6 percent were found to have visible calculi up to 8 mm. in size adherent to renal papillae.

Rosenow, Jr., has confirmed the work done by Randall in renal studies in 239 consecutive necropsies at the Mayo Clinic. Plaques of calcareous materials were found in the renal papillae in 22.2 percent of all cases examined. Calculi were found in 4.5 percent of all cases and in 5 cases they were adherent to the renal papillae. He further found bacteria present in the papillae in 24 out of 37 cases examined or 64.9 percent of such cases. He states that age, sex, grade of arteriosclerosis, and necropsy diagnosis were not important factors.

Anderson microscopically examined kidneys from 1,500 autopsies for calcium deposits. He reports that 180 cases (12 percent) showed microscopic deposits of calcium. Of this group there were 540 infants, with 31 cases of renal calcification (5.7 percent). In 960 adults, 149 cases (15.5 percent) showed renal calcium deposits. No cases of parathyroid adenoma or mercury bichloride poisoning were included in the series. Quoting Anderson: "Out of 140 cases in adults, in 25 instances the deposit could be described as moderate, but in the remaining 115 there were found only a single deposit or several small areas of calcification. In all cases there was some evidence of renal damage, usually vascular. It could not be said, in any case, that calcium had become deposited in entirely normal renal tissue. Evidently most of the small areas of calcium deposition were on a dystrophic basis, i. e., the calcium was laid down in degenerated tissue, or in dead material, as in tubular lumens. In several cases partial calcification of desquamative or hyaline material held in tubular lumens was noted. In no instance was the calcification of the marked degree or character such as has been described in cases of hyperparathyroidism. It seems unlikely that these small deposits of calcium have any significant effect on renal function. Probably they are of serious import only in those instances in which the deposition is in renal papillae, where they may act as a nidus for stone formation in the fashion that Randall has described.

The small deposits of calcium did not occur in any constant position. Most commonly they were small calcium-containing casts within the lumens of tubules. Some were interstitial in position (fig. 1). A distinct peri-tubular deposition was least common. The cortex of the kidney was more commonly involved than the medulla, though the renal papilla, or just beneath the pelvic epithelium, were not uncommon sights. A connection with early calculus formation was noted in two instances. In one of these cases several small plaques of calcium were deposited in the subepithelial tissue adjacent to the renal pelvis. Attached to the central portions of the plaques, in one instance by a narrow necklike portion, were minute laminated calculi (fig. 2). The plaques and the attached calculi were of different and variable densities. The appearance of these interstitial deposits of calcium, to which minute calculi are still attached, entirely supports Randall's description of the pathogenesis of renal calculi.
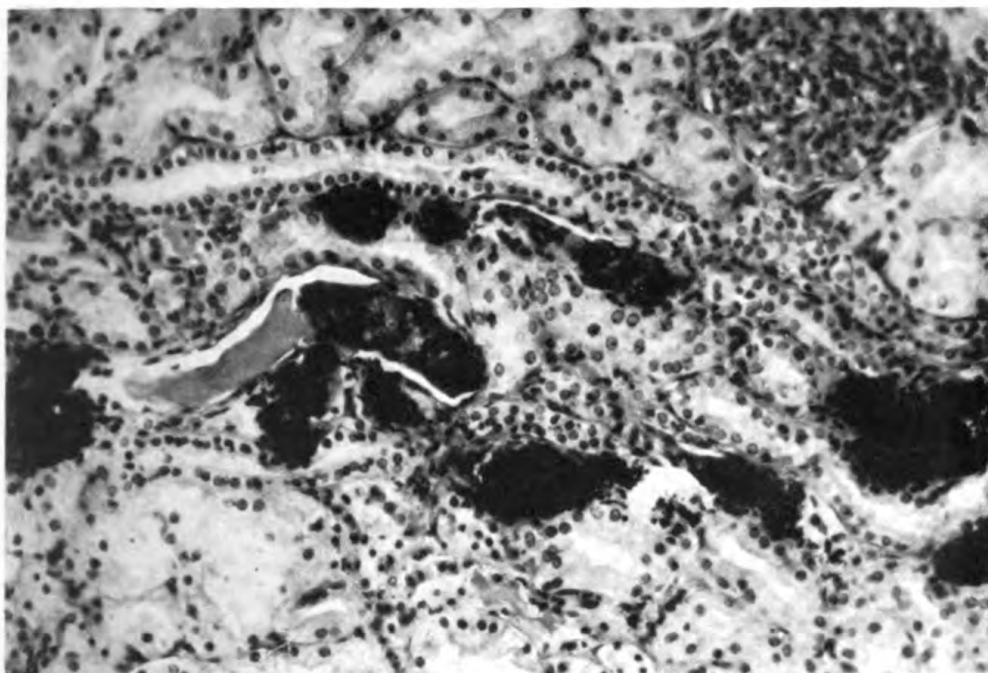
FIGURE 1.—RENAL CORTEX. X 200 INTRATUBULAR AND INTERSTITIAL CALCIUM
DEPOSITS. NOTE PARTICULARLY PARTIAL CALCIFICATION OF AN INTRATUBULAR
CAST.

FIGURE 2.—CALCIUM PLAQUE IN TISSUE WITH ATTACHED EARLY RENAL CALCULUS.
X 600. NOTE NARROW, NECKLIKE ATTACHMENT OF CALCULUS AND ITS LAMI-
NATED STRUCTURE. PRESUMABLY FROM SUCCESSIVE DEPOSITION OF PRECIPI-
TATED MATERIAL.

Secondary renal calculi are those that are commonly seen in the urinary tract as a result of infection, with or without stasis or foreign body. These calculi form on minute clumps of pus cells and bacteria, or blood clots and foreign bodies. The type of calculi formed will depend on the reaction of the urine and this, of course, will depend on the charatcer of infection present, i. e., whether the bacteria are urea splitting or not. These stones will usually be a mixture of phosphates, carbonates, oxalates, and urates. The phosphates and carbonates are deposited in alkaline urine and the oxalates and urates in an acid urine.

ETIOLOGY

1. INFECTION WITH OR WITHOUT STASIS, BLOOD CLOTS, AND FOREIGN BODIES

> (a) Staphylococcus albus.
> (b) B. coli.
> (c) B. proteus.
> (d) Alpha haemolytic streptococcus.
> (e) B. influenzae.

2. METABOLIC DISTURBANCES.

> (a) Gout.
> (b) Cystinuria.
> (c) Hyperparathyroidism.
> (d) Hypercalcinuria (decreased osteoblastic activity).
> (e) Oxaluria.

3. VITAMIN A DEFICIENCY.

4. DIET.

> (a) High calcium (milk and cheese).
> (b) High alkalinity (Sippy regime).

5. DRUGS.

> (a) Sulfanilamide.
> (b) Sulfapyridine.
> (c) Sulfathiazole.
> (d) Ammonium Chloride.
> (e) Acid Sodium Phosphate.

6. FLUID IMBALANCE.

INFECTION

Bartlett in 1895 stated that formation of renal calculi is caused by two factors, namely, infection and stasis. Later, in 1906, Whitacre described two types of kidney stones: first, the primary formed in the tubules or calices in the presence of an acid urine; and the secondary were formed in an already damaged kidney, and as a result of chemical changes in urine, and the presence of micro-organisms, lime salts were precipitated.

In 1926 Hager and Magath demonstrated that calculi were formed in the presence of *Bacillus proteus* which was capable of breaking up urea into carbon dioxide and ammonia. It has since been demonstrated by Barney, Jones, Chute, and Suby that numerous other organisms, either alone or in combination, are urea splitters. Barney in a careful analysis of 100 cases of lithiasis found organisms, known to be urea splitters, were present in 46 percent, including *B-coli*, *B-proteus*, *Staph-albus*, *Alpha haemolytic streptococcus* and *B-influenzae*. Recently Chute and Suby reported 90 cases of renal lithiasis in which urea-splitting organisms were present in 54 percent and nearly three-fourths (74 percent) of all their infected cases.

Stasis was found to be present in 24 percent of the cases presented by Barney and Jones. Stasis undoubtedly plays an important role in the formation of some calculi but one can recall many instances of its presence without stone formation. However, when present in any part of the urinary tract, stasis should be eliminated. Calculi occurring in the presence of urinary stasis and infection make it practically impossible to separate the cause and effect.

Twinem has recently stressed the importance of poor drainage of a calyx, either because of restricted outlet, angulation, or dependency as a factor in the formation of calculi. Certainly the presence of poor drainage plus urea-splitting organisms almost assures the formation of a stone.

The roll of extra renal infection in the formation of urinary calculi was claimed for certain strains of bacteria, especially *streptococci*, by Rosenow, Jr., and later by Meisser. Although they submitted very good arguments at the time and had many adherents, clinical evidence in the past few years has not borne out their original claims.

METABOLIC DISTURBANCES

Hyperparathyroidism has been reported on by Albright, Bauer, Cope and others in numerous publications. In 1939 Chute reported 36 cases of hyperparathyroidism, with urinary lithiasis in 83 percent. The calculi were bilateral in 53 percent and multiple in 73 percent. Barney (et al.) states that the calcinuria induced by parathyroid disease is one of the most important causes of renal lithiasis, comprising between 3 and 4 percent of all their cases. No recurrences have been observed following the removal of the pathological parathyroid gland. Calcium content of urine can be easily estimated by the use of a solution devised by Sulkowitch. A negative test will rule out hyperparathyroidism. If the test shows an excess of calcium, a blood calcium and blood phosphorus can then be run, to rule in or out, a diseased parathyroid gland.

Gout, cystinuria, and oxaluria are all etiological factors in stone formation. Calculi are infrequently seen in gout and cystinuria.

Oxaluria more frequently seen, is an important factor in stone formation, and also is one which I believe is frequently missed.

The hypercalcinuria noted in patients bed-ridden or sedentary for long periods is caused by the decrease of osteoblastic activity in the bone while the osteoclastic activity continues. In these patients the possibility of stone formation is great because the calcium content of the urine may reach such a high level that it may be precipitated out in the kidneys or other parts of the urinary tract. Added to this, long recumbent positions may decrease renal drainage, even though the degree of stasis may be so slight as to be difficult to demonstrate. Hence you have an ideal condition for the formation of urinary calculi.

VITAMIN A DEFICIENCY

Experimental production of urinary calculi in animals on a deficient vitamin A diet has been reported by Higgins, Osborne and Mendel, McCarrison, Livermore, Fujimaki and many others. These articles appeared in the urological literature mainly in the last 10 years. However, clinical confirmation has recently failed to substantiate these earlier claims. Barney states clinical experience has shown that where stones and vitamin A deficiency co-exist, the administration of vitamin A will not in itself remove the stone by dissolution or otherwise. He thinks it is a problem for further study. Keyser states that American patients with stones generally eat a diet adequate in vitamins, and from a clinical standpoint thinks the evidence that vitamin A deficiency is a factor in lithiasis is suggestive but inconclusive. By means of the biophotometric dark adaptation test, vitamin A deficiency in stone-bearing patients has recently been brought out. So far the significance of the biophotometric dark adaption test has not been entirely established. In the southern part of the United States and South Africa calculi are rarely found in the Negroes whose diet is apparently more adequate in vitamins than in the white population. In the latter group urinary calculi are reported fairly high in these two areas. The above fact has recently been stressed by Livermore who found 22 cases of nephrolithiasis out of 17,420 general hospital admissions in Memphis, Tenn., while there were 18 cases out of 52,257 in the Negroes. These figures show that renal calculi form nearly four times as often in the white race as in the Negro. Vermooten failed to find any renal calculi in over 1 million admissions in the Negro, as proved by hospital records in South Africa, while in the same area out of 126,000 hospital admissions for the white race, 1 out of every 460 hospital admissions had renal calculi. He states that the diet of the South African Negro is an acid ash diet with high vitamin A content. The diet in the Negro in the South consists mainly of molasses, corn bread, turnip greens, bacon side meat, and cabbage. This is also an acid ash, high vitamin A diet. Hence it is felt that a

deficient vitamin A diet is probably an important factor in formation of urinary calculi and has an important place in prevention of recurrences.

DIET

Barney and Jones state that in 39 percent of 100 carefully analyzed cases of renal calculi it was noted that these patients consumed what was regarded as excessive amounts of cheese, milk, or alkalies for a long period. Because milk and cheese are notably rich in calcium phosphate, individuals who consume large amounts of these foods may, and often do, form phosphatic calculi. Patients on a Sippy regime, because of an alkaline urine over a long period of time, should create an ideal condition for formation of urinary calculi. However, Kretschmer and Brown found only 1.2 percent of 1,260 patients on duodenal ulcer treatment had urinary calculi. Eisele, however, in a recent study of 519 duodenal ulcer patients, found urinary lithiasis in 11.1 percent. He was unable to account for the discrepancies between his and Kretschmer's figures. It is felt that any excess in diet, either in the calcium phosphate found mainly in milk and cheese, or those on alkaline diets are more liable to form calculi because the alkaline urine and increased calcinuria and phosphaturia.

DRUGS

Ammonium chloride and acid sodium phosphate, frequently used as acidifying agents, may produce hypercalcinuria and in this way provide a factor for stone formation. Sulfanilamide, sulfapyridine, and sulfathiazole may cause formation of calculi. With sulfanilamide this has recently been noted with one of my cases. This patient had an acid urine and B. coli infection of the left kidney, but no urinary calculi were found during a complete urological examination. However, after 3 days on 60 grains daily of sulfanilamide, the left ureter became blocked with small soft phosphatic calculi. Urine was pH 8, loaded with R. B. C. and phosphates. The calculi were easily removed by ureteral catheterization. Antopol (et al.) have shown that sulfapyridine calculi may form quickly in the renal tubules or pelvis. About 6 months ago I had a patient with a severe right ureteral colic who had been treated with 90 grains of sulfapyridine for 3 days for cellulitis of the lower left leg. He had been running a high temperature, the weather was unusually warm and his fluid output was low. The urine was loaded with sulfapyridine crystals and red blood cells. The lower right ureter was found to be blocked with sulfapyridine crystals, which was relieved by catheterization, increased fluid intake, and of course, discontinuing of the drug. These calculi are not seen by x-ray. So far I have noted no urinary calculi in patients on sulfathiazole.

FLUID IMBALANCE

Fluid imbalance, noted in people in hot climates where there is excessive perspiration and low urinary output, certainly is a factor in the formation of uric acid and oxalate calculi. The urine of these people are loaded with uric acid and oxalate crystals which are precipitated because the collodial mechanism, which usually holds crystalline material in solution, is unbalanced. This has been found to be so in the naval service with individuals working in firerooms or other hot areas aboard ship. These patients are free from renal infection and have small sharp irregular calculi which are not usually demonstrated by x-ray but are diagnosed by ureteral catheter, either plain or with wax tip. The ureteral colic seen in these cases is severe and urine is loaded with R. B. C. One attack is usually enough to convince the individual that he must keep up his fluid balance. This has been particularly noted during a tour of duty at the Naval Hospital, Canacao, P. I. and the Naval Hospital, Pearl Harbor, T. H.

Livermore states that in India, China, and Afghanistan, because of an intense hot, dry climate there is excessive perspiration and the natives void only 3 to 4 ounces of concentrated urine in 24 hours. In these areas urinary calculi are nearly universal. Jolly thinks the deficient vitamin A diet is responsible for the high incidence of stones in these areas. No doubt both the deficient vitamin A diet and marked fluid imbalance are responsible for such a high incidence of urinary calculi.

METHODS OF PROCEDURE

Given a case with urinary calculus there are several steps to determining, if possible, the etiology of the stone, its character, treatment, prognosis, and the probability of recurrence:

1. By x-ray examination, including intravenous pyelogram, a large percentage of calculi appear. Uric acid stones are usually not seen. The cystin stones have a homogenous wax-like quality; phosphatic stones are dense and have a more or less laminated structure; the calcium oxalate stones have a "snow-flake" appearance; the stag-horn calculi are usually a mixture of phosphates, cystin, and oxalates with phosphates predominating. Hence from the x-ray examination a lead on the type of calculus present can be obtained.

2. In taking the history the patient is carefully questioned as to his dietary habits, especially in regard to foods with high calcium and high oxalate content.

3. Careful urine examination should include cultures. If such organisms are present that are known to be urea-splitters, the etiological factor may have been found.

Another urine examination that is essential is the determination of the calcium content of the urine, which can be easily and quickly

done. To 5 cc. of oxalate buffer mixture [1] an equal amount of urine is added, which if not acid, should be acidified with 50 percent acetic acid. Sulkowitch devised this solution and it has had enough use that its reliability is assured. In using the test it is necessary that such drugs as ammonium chloride, sodium acid phosphate, sulfanilamide, sulfapyridine, and sulfathiazole be discontinued, and the high calcium foods such as milk and cheese should be eliminated.

Interpretation.—The turbidity produced by the calcium oxalate precipitate may be interpreted as follows:

No precipitate at end of 2 minutes____ No calcium.
A fine white cloud_____ Small amount of calcium.
A moderately dense white cloud_____ Moderate to large amount of calcium.
An extremely dense white cloud, having an appearance resembling milk, and appearing almost immediately after the addition of the reagent, even before the mixture is shaken_____ Very large amount of calcium.

4. If the urine shows a large amount of calcium the blood calcium and blood phosphorus should then be done. Hypercalcinuria may be found in hyperparathyroidism, menopausal osteoporis, Cushing's syndrome and in patients confined in bed for long periods of time. The bony changes in the above conditions should be studied by x-ray.

5. Chemical analysis of the stone is of the utmost importance in determining what etiological factors are present:

   1. Phosphate and carbonate calculi:
     Alkaline urine.
       (*a*) Urea-splitting infection.
       (*b*) Sippy regime.
     Hyperparathyroidism.
   2. Calcium oxalate stones indicate a high oxaluria and are also seen in fluid imbalance.
   3. Cystin indicates a cystinuria which is found in a disturbed protein metabolism.
   4. Uric acid, suggests gout and fluid imbalance.

TREATMENT

Surgical procedures for removal of stones from kidney or renal pelvis are too well known to need discussion here. However, I would like to stress the importance of renal suspension to insure adequate renal drainage in all cases. Without proper drainage, renal infections present in a high percentage of cases, cannot be successfully treated.

Parathyroidectomy, of course, is indicated in the treatment of urinary calculi found in hyperthyroid disease.

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[1] 2.5 gm. oxalic acid, 2.5 gm. ammonium oxalate, and 5 cc. of glacial acetic acid are dissolved in distilled water, and made up to volume of 150 cc.

Transurethral manipulation of ureteral calculi has been used exten-
sively the past several years with great success. Numerous devices
for engaging the stone and removing it from the ureter have been in-
vented. Most of these work on a basket principle, but are certainly
not without danger, since they may become fast in the ureter or do
extensive damage to it. The procedure I have recently had excellent
results with has been:

1. The patient is given 5 cc. of depropanex intra-muscularly 5 minutes before
cystoscopy.

2. One or two catheters are passed up the ureter after the orifice is incised
and an attempt is made to pass one catheter past the stone. If successful, the
catheter is left in place.

3. The lower ureter is then dilated with bulbs size F12, F14, or F16. Then
with the bulb against the calculus, 5 cc. of warm mineral oil are instilled, fol-
lowed by 5 cc. of avertin solution (made to table of 100 mm. per kilogram of body
weight). The bulb is then withdrawn and the inlying catheter left in, usually
over night, and the following day it is withdrawn, depending, of course, on
the condition of the kidney above the obstruction. Using this method, we have
been able to remove ureteral calculi from 34 out of 36 cases. In only 2 cases
was uretero-lithotomy performed. Depropanex is an effective, smooth, muscle-
relaxing agent and enables these patients to go through what ordinarily would
be a painful procedure with very little discomfort. The accompanying chart
shows the results obtained by this method.

MEDICAL

As indicated previously all patients who have had calculi com-
posed of phosphates or carbonates should have an acid-ash diet, plus
vitamin A, and a large fluid intake.

Foods that are high in calcium content, i. e., milk and cheese, should
be eliminated. This will also be effective with calcium oxalate stones.
However, if the patient suffers from endogenous oxaluria, the chances
are that the stone formation will continue unchecked. In cystin and
uric acid stones a combination of alkaline therapy, forcing fluids, and
low protein diet is often successful.

Urinary tract infections following removal of calculi must be elim-
inated if we hope to prevent a recurrence. The newer drugs, sul-
fanilamide and sudfathiazole have aided greatly in clearing up these
infections. Sulfanilamide is very efficient in B-coli and certain cases
of *B-proteus* infection. Helmholz reports that sulfathiazole is bac-
tericidal for six of the commonest bacteria found in urinary tract
infection, namely, *Pseudomonas aeruginosa*, *Streptococcus faecalis*,
Escherichia coli, *Aerobacter aerogenes*, *Proteus ammonia*, and *Staphy-
lococcus aureus*. Personal experience with sulfathiazole bears this out.
All of my cases, excepting one, postoperatively have been cleared of
their infection with sulfanilamide, or sulfathiazole. In this one case
there was a dual infection of *B-coli* and *staphylococcus albus*.

Attempts to acidify an alkaline urine in the presence of urea-splitting organisms will usually meet with failure until infection has been eliminated. Also as previously mentioned, acidifying agents not only produce an increased calcium in the urine which is not desirable, but in the presence of serious renal damage may produce an acidosis.

Foci of infection should be looked for in all cases, not only in the teeth, tonsils, sinuses, middle ear and intestinal tract, but also the prostate and the cervix should be carefully checked. The prostate and cervix often act as foci in renal infections which are frequently missed. In addition I believe we pay too little attention to stasis in the intestinal tract.

A dissolution of stones by various methods is appearing more frequently in the literature. Barney states "Dissolution of stone by various acids will be used in an increasing number of cases. All we need for this purpose is a cheap nonirritating acid which does its work quickly; but that goal has not yet been achieved. Not only this but the technical difficulties of dissolving a stone in the kidney are real and numerous." Personally I have had no success in dissolving stones but shall keep trying.

RECURRENCE

Chute and Suby in 90 cases of renal calculi found recurrences in 73 percent out of 48 cases infected with urea-splitting organisms. In the cases with non-urea-splitting infection they had 23 percent recurrence. While in those with sterile urine, 29 percent had recurrences. This is not a very encouraging picture, but it is felt that it can be markedly improved by careful study of the etiological factors and follow-up treatment on each case.

Important factors in the prevention of recurrence may be listed as follows:

1. Eliminate infection and secure good drainage.
2. Force fluid—4 to 6 thousand cc. daily.
3. Acid ash diet in all cases except those with uric acid and cystine stones.
4. Vitamin A in adequate dosages.
5. Eliminate foods or drugs that produce a high hypercalcinuria or alkaline urine.
6. All cases should be checked frequently with frequent urine and x-ray examinations.

The above procedure has been carried out on 36 cases of ureteral calculi and 10 cases of renal calculi in an effort to prevent recurrence. Follow-up studies on 84 percent of these cases has been done, and although the time interval is short (3 to 22 months) there has been only one recurrence. It is felt that a great deal can be done to eliminate the factors that cause recurrence.

TABLE 1.—*Ureteral calculi*

NEGATIVE CULTURES

Initials	Case No.	Type of stone	Culture	Reaction	Size	Side	Method of removal
F. M. S.	24294	Cal-oxalate	Negative	Acid	5 x 10 mm	Right	6 manipulations; mineral oil and avertin and depropanex injected.
O. A. D.	24904	Uric-acid	do	do	3 x 4 mm	Left	2 manipulations; mineral oil and avertin injected.
L. A. W.	26383	do	do	do	2 x 3 mm	do	Do.
F. O. A.	26322	Urate	do	do	2 x 3 mm	do	1 manipulation; mineral oil and avertin injected.
A. A. S.	26537	Cal-oxalate	do	do	7 x 10 mm	do	2 manipulations; stone extracted by cystoscopic forceps.
N. B. B.	25770	Urate and oxalate	do	do	3 x 4 mm	Right	3 manipulations; mineral oil and avertin injected.
J. B.	26245	Uric acid	do	do	2 x 4 mm	Left	1 manipulation; mineral oil and avertin injected.
F. A. C.	23062	Urates	do	do	3 x 4 mm	do	Do.
F. G.	22905	Urate	do	do	3 x 4 mm	do	Do.
R. W. S.	22901	do	do	do	2 x 3 mm	do	1 manipulation; stone passed spontaneously; atropine and force fluids.
M. W. B.	27747	Uric-acid	do	do	6 x 6 mm	Right	4 manipulations; mineral oil injected; depropanex intramuscularly.
A. J. M.	26310	Urate and oxalate	do	do	2 x 3 mm	do	Dilatation of right ureter.
L. M. W.	23258	Cal-oxalate	do	do	2 x 3 mm	Left	Dilatation of left ureter.
A.	Queens	do	do	do	3 x 4 mm	do	2 manipulations; mineral oil and avertin injected.

GRAM NEGATIVE BACILLI CULTURES

Initials	Case No.	Type of stone	Culture	Reaction	Size	Side	Method of removal
J. A. R.	24120	Cal-oxalate	B-coli	Acid	1 x 3 mm	Left	2 manipulations; mineral oil and avertin injected.
C. E. N.	24672	Phosphate and carbonate	do	Alkaline	2 x 3 mm	Right	1 manipulation; catheters only.
D. L. L.	25981	Cal-oxalate	do	Acid	2 x 3 mm	Left	2 manipulations; mineral oil and avertin injected.
A. H. M.	28615	Oxalate and urate	do	do	2 x 8 mm	Right	Do.
V. G.	Queens	do	do	do	8 x 10 mm	do	2 manipulations; mineral oil and avertin injected; depropanex intramuscularly.
V. G.	Queens	do	do	do	10 x 12 mm	Left	Left ureterolithotomy.

TABLE 1.—*Ureteral calculi*—Continued

STAPHYLOCOCCUS ALBUS CULTURES

Initials	Case No.	Type of stone	Culture	Reaction	Size	Side	Method of removal
M. J. E.	25655	Carbonate and phosphate.	Staph-albus	Acid		Left	2 manipulations; mineral oil and avertin injected.
J. P.	22257	Uric acid	do	do	4 stones 2 x 3 mm	Right and left	Do.
D. P.	Queens	Urate and oxalate.	do	do	7 x 9 mm	Left	4 manipulations; mineral oil and avertin.

COMBINED STAPHYLOCOCCUS AND GRAM NEGATIVE BACILLI INFECTIONS

Initials	Case No.	Type of stone	Culture	Reaction	Size	Side	Method of removal
W. W.	26611	Cal-oxalate	Staph-albus and B-coli.	Acid	8 x 10 mm	Left	2 manipulations; mineral oil and avertin injected.
J. H. H.	24888	Oxalate and phosphate.	do	do	do	do	Left ureterlithotomy.
J. H. H.	24888	do	do	do	6 x 12 mm	Right	3 manipulations; mineral oil and avertin injected.

TABLE 2.—*Kidney calculi*

Initials	Case No.	Type of stone	Culture	Reaction	Size	Side	Method of removal
J. J. S.	27129	Oxalate-urate	B-coli	Acid	7 x 7 mm	Left	Left pyelolithotomy.
D. R. C.	23194	Uric acid and phosphate.	do	do	6 x 12 mm	Right	Right pyleolithotomy.
J. A. H.	20473	Phosphate and cal-oxalate.	do	do	Large stag horn.	do	Left nephrectomy.
F. A. L.	22247	Urate and cal-oxalate.	Staph-albus	do	2 x 3 mm	do	Left nephrolithotomy.
W. J. F.	22413	Mixed urate and phosphate.	do	do	Large stag horn.	do	Left pyleolithotomy.
J. F. H.	22007	Phosphate and cal-oxalate.	do	do	1¼ x ½ cm	Right	Right nephrectomy.
C. N. S.	28047	Cal-oxalate and urate and phosphate.	Strept-aureus	do	Large stag horn.	Left	Left nephrolithotomy.
J. B.	Queens	Oxalate and phosphate.	Staph-albus, B-coli	do	1¼ x 2 cms.	Right	Right pyleolithotomy.
K.	Queens	do	do	do	1 x 2½ cms.	do	Do.
B.	Queens	do	do	do	10 x 12 mm.	do	Right nephrectomy.

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THE SCOPE OF PSYCHIATRY IN MILITARY MEDICINE WITH SPECIAL REFERENCE TO THE NAVY[1]

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At the Medical Congress in Nantes in 1909, Dr. Granjoux (1) posed the query, "Why are there crazy people in the Army?—Because we do nothing to prevent it!" This simple question and answer describe very adequately the state of the prophylactic side of military psychiatry at that time. A few years earlier in 1904, Borischpolski (2) had organized the first psychiatric field service in Harbin, Manchuria, and had demonstrated that psychiatric casualties in the form of psychoses constituted a grave problem in warfare, and that a psychiatric field service was entirely practical. However, nothing was done at the time of recruiting or during training to eliminate those who might later develop psychoses or neuroses. The first real attempt to accomplish this purpose was made by the United States on entry into the last World War and there is some indication that even with the relatively crude methods then available, we achieved a lower percentage of psychiatric casualties than did other nations. With prophylactic technics based on our present knowledge we could achieve even better results. Thus we would aid in establishing greater fighting efficiency which, after all, is the goal of anyone in the military organization whether he be an officer of the line or of the staff.

Let me emphasize that I harbor no illusions of the omniscience or omnipotence of the psychiatrist. I am aware of the limitations placed upon him by the vastness of the problem, the imperfections of psychiatric knowledge and technics, and by the particular requirements characteristic of any military organization.

The primary function of psychiatry in the armed forces, as I see it, is to aid in the selection of efficient personnel, and to weed out those unfit from a psychiatric point of view. The question of treatment is secondary to this function and has its place in maintaining the psychic health of the fighting unit or to render assistance to those who happen to break down during their later period of service. The organization for this latter function has existed for many years in the Navy. However, a machinery to serve the function of maintaining the psychic health does not exist, nor is it likely to be organized as such until we have considerably more knowledge of the motivations behind group behavior or the structure of what we call morale. The experienced line officer who has spent years in the service knows more about maintaining morale than the psychiatrist, although a systematic

study of the problem from a psychiatric point of view should yield results of practical importance.

Before launching on a discussion of the specific problems facing us, and how we propose to meet them, I want to present some historical reflections which will serve for background to the later considerations of the current and future problems.

The development of military psychiatry has of course been colored by the psychiatric theory and practice in vogue at any given period, but as in many other realms of psychiatric endeavor it could scarcely be said that military psychiatry represented the most advanced thinking in the field. From the time of Pinel (3) and Esquirol (4) we have some very astute and accurate descriptions of individual cases but no attempts at systematizing the subject. These accounts are mainly of psychotic conditions, and only rarely do we meet with descriptions of neuroses.

The early nineteenth century concept of neurosis was quite different from our modern view; for instance many conditions now included among the neuroses were then counted among the "manias" or they were considered as being of organic nature.

This and the fact that psychotic reactions are usually more evident account for the preponderance of descriptions of psychoses over neuroses in the early literature.

Another factor explaining the paucity of military psychiatric literature of the early nineteenth century is that public health questions relative to the military organization, or for that matter to the general population, were little understood, nor did the governments concern themselves with these questions except in such obviously dangerous situations as cholera or bubonic plague. However, as the humanizing influence of Pinel and Esquirol made its imprint upon the theory and practice of civilian psychiatry so the military physicians came to occupy themselves increasingly with psychiatric questions in military life, and by the time of the Franco-Prussian War we begin to find a number of articles which in their scope are more inclusive than those earlier clinical case histories.

Scanning the literature from 1870 to 1875 one is struck by the lack of foresight as regards elimination of the mentally and emotionally unfit and also by the utter lack of facilities for the disposal of frank psychotics. Many were never admitted to the field hospitals but were sent directly to their home communities without the benefit of any medical assistance. Others were treated in field and other hospitals simply because they happened to have physical injuries. Throughout the Prussian Army which numbered 850,000 men, only 316 psychiatric diagnoses were made during the whole Franco-Prussian War.

In the last World War there were from 17 to 30 psychiatric diagnoses made per thousand men or from 40 to 75 times as many as during the Franco-Prussian War.

That there was no appreciation of the serious problem presented by neurotic conditions in members of the armed forces is amply attested by the literature, for although there are many descriptions of neurotic breakdowns under service conditions there is no mention of the concept of neurotic predisposition or of any attempt at elimination of such individuals before breakdown. About the only basis for elimination which could be termed psychiatric was that of "non compos mentis" into which classification was relegated everything from actively hallucinated persons to oligophrenics. This does not mean that the experiences in military psychiatry from this period are of no interest to us. On the contrary we should be able to extract from them any number of points of practical value. To illustrate this point we may briefly examine two accounts of the siege of Paris in 1871 written by physicians of the opposing armies. Sarazin, (5) the Frenchman who was inside the beleaguered city, wrote, "Observation is an instinct in the physician; I am attempting to describe the psychic condition of those men who surround me. If I begin with myself I find to my astonishment that I have given way to apathy, I follow the course of events with indifference, I am no longer myself, all mental elasticity is lost. Evidently a human being has only a certain amount of energy. When that is consumed a certain time-lapse is necessary to regain it."

He spoke of the prevalence of "melancholia with nutritional disturbances" and deliria with attacks of rage or attempts at suicide. It is of particular interest that he also described "neurasthenic prodromal stages."

After weeks of siege, Sarazin noted a predominance of severe exhaustive states with serious physical symptoms of the same kind described by Mira (6) during the recent civil war in Spain and by Sargent and Slater (7) from their experiences with men returning from the Flanders retreat in May 1940. I mention this because I wish to point out that the condition termed "malignant anxiety" by Mira was well known 70 years ago, perhaps earlier. Not only that, but Sarazin correctly ascribed the whole reaction to the emotional trauma rather than to any physical agent such as, for instance, the "contusion neuroses" described by the Russian psychiatrists during the first world war.

With Sarazin's experiences in mind we will examine the account of Arndt (8) who was with the German troops outside the beleaguered city. These troops were always on the offensive, they had little shelling and no hunger to endure, but they were subjected to the constant

disturbance of their own gun fire. In essence they showed the same sort of reactions as the French inside the city. Arndt says that neuroses and "light psychoses" were extraordinarily frequent. "After a while there developed a severe neuropathic condition (in the troops). In some it showed itself in instability, irritability, and a complaining attitude. In others it was evidenced by a depressed or rather desperate apathy which could be broken only by external demands for action."

In spite of the clarity of their understanding of the stresses of military life, the authors nowhere mention anything about prophylactic measures. From our present point of view it would seem possible to prevent a too great incidence of reactions of this sort. First, through proper selection of men, second, through proper indoctrination, and third, through prophylaxis or very early treatment in the field. The matter of indoctrination is one which deserves more space than can be given in this paper, and one which I feel incompetent to discuss except to point out that warfare being to most of us a very abhorrent occupation, it must be presented in such a light as to allow the individual to mobilize all his aggressive urges in the service of the Nation. This presupposes a profound knowledge of both social and individual psychological forces on the part of those who plan such indoctrination.

The young men of our Nation hardly show the same vital interest in national affairs as do the Finns for instance, nor do they display the chauvinistic zeal of the German youth. They also lack a personified enemy which both the above-mentioned nations possess. To get our youth to the point where they will show these qualities in a practical way is no small task but I know that we have psychiatrists whose guidance in this direction would be of real value. It is not only a question of military training to the end that the individual may become an expert gunner or pilot but also a question of training the feelings, in order to supply a motive force of sufficient strength that the men will unflinchingly face the dangers and rigors of warfare. The time element is of greatest importance here for we are committed to a program of training recruits for very complicated tasks in a very short time. With many years at our disposal the problem would have a different and not quite so difficult an aspect.

To continue the historical reflections let me cite briefly the experiences of Hesnard, (9) the French naval surgeon who has written much and excellently on psychiatric problems. He tells us of the explosions on the "Iena" and the "Liberté" at Toulon in 1907 and 1911. A large number of sailors and officers were killed and maimed. The catastrophes came out of a clear sky much like the blowing up of the "Maine" in Havana harbor. Hesnard describes various types of reac-

tions among the survivors. There were those who exhibited minor emotional symptoms and those who responded to the disaster with psychotic reactions. Of particular interest to us in the light of the descriptions of the reactions of the English soldiers returning from Flanders in 1940 are his accounts of the somnambulistic states, the automatic mental activity, the absorption in trivial occupations such as saving some worthless article, and the temporary exaltations followed by amnesia. Even some of the rescuers showed for several weeks symptoms of mental unrest, obsessive repetition of the scene, terrifying dreams, diffuse anxiety, fatigue and various other symptoms. Both the crews and the civilian population in the town suffered from what Hesnard described as a "collective morbid state" which particularly manifested itself in the panic which occurred at the funeral of the victims. Among those who exhibited serious symptoms of psychotic nature there were a few whose past history would have led us to regard as having some predisposition to psychotic reaction. In these cases he observed a period of mental equilibrium which one might consider as a kind of incubation period. Following this there was a phase of fatigue, nightmares, and mental retardation, preceding a state of confusion associated with anxiety and excitement. He too mentioned the severe disturbances of nutrition which sometimes characterize these conditions.

After almost every naval skirmish, disaster or even threatened catastrophe, there are some psychotic casualties serious enough to be hospitalized. It would be instructive indeed if we had complete data on these cases but unfortunately they cannot be easily obtained. The emotional effect of danger cannot be overemphasized. The importance of having only the most stable of individuals in the service is obvious. And yet one cannot help but lament the fact that we have to expose just such men to possible annihilation. Being committed, however, to realistic thinking in this matter we have to recognize the necessity of using the best of our young men in such hazardous occupations as the military. If we do not select our men carefully our striking power will be greatly impaired. There is, of course, this intangible yet real something which we call spirit but it cannot altogether make up for lack of initiative, knowledge and physical stamina. When the final chapter of the present World War is written it will be interesting and instructive to examine the emotional forces at work in the German army in Flanders. From newspaper accounts it appeared that a great many made up in enthusiasm, or I should say frenzy, for what they lacked in judgment. The same was true of our green troops in the last war, who allowed themselves to be heroically wiped out in the heat of battle when other more seasoned troops achieved greater results with less casualties.

Such useless human sacrifice was the result of mass hysteria akin to that seen in revolutions and in quasi religious movements such as the flagellants of the Middle Ages. It could have been prevented if we had realized the importance of absolute adherence to rigid discipline. At the risk of being accused of stepping outside the frame of psychiatry I want to dilate on the subject of discipline. The military organization, unlike the civilian community, cannot allow for individual differences. It is in fact totalitarian, but for us, a totalitarian machine in the service of democracy. It must move in concert, every move being coordinated with those already made and those to be made. All this means that the individual must submerge his personal self and become part of the greater self of his ship or his battalion. To do this in time of peace is not so difficult, although we know that many are unable to subjugate their individualities to the demands of the service. They respond emotionally in ways which we describe as neurotic and psychotic. War time demands are still more rigorous and we must expect that many who were able to adjust to peacetime military service will be unable to bear the additional burden of oft repeated danger to their lives.

This brings us to a very important question. How are we going to predict which ones will break? There is no simple answer to this question. All we can do is to be more vigilant than ever in selecting what we believe are the best men, and what is equally important we must constantly watch for symptoms and signs of beginning emotional unrest in those who are already in the service.

For years we have been aware of the problem of weeding out the mentally and emotionally unfit recruits. Our technics have been relatively adequate but they are not adequate enough for present and future needs. For this reason we are attempting to perfect our methods of early recognition of men who are likely to break down emotionally.

It is obvious that men of subnormal intellect have no place in the armed forces. Such individuals are not difficult to eliminate. If they are not recognized on sight at the recruiting station the results of the formal intelligence tests will indicate their insufficient intellectual endowment.

The frank psychotics usually present symptoms which are detectable by even the relatively inexperienced person and therefore this group does not present any particular problem. It is obvious that an actively hallucinated person or one who is depressed or in a manic phase is easily spotted. A few questions will clinch the diagnosis if the eye has not already established it.

Recruits who have fully developed psychoneuroses are not suitable military material. Past experience shows us that particularly the

anxiety neurotics and those leaning toward the hysterical conversion pattern were prone to break down and remain unfit for combatant duty. The figures indicate that only slightly over 1 percent of such cases ever became sufficiently recovered to perform front line duty. Even well established neurotic conditions can be very effectively concealed from the observer if the patient wishes to do so. The main reason for joining the service may be part of the recruit's neurosis. I have been told by medical men of long experience in the Navy and by social workers, that there is a not inconsiderable group of neurotic break-downs in men who have unusually over-protective mothers. To such a person, joining the service may signify escape from the mother, but he cannot forsee the psychological implication of military discipline and he finds that he is worse off than at home. His powers of adjustment fail him and he responds with a neurosis the form of which depends upon his earlier personality type, his patterns of behavior and of course his life experience. It is often exceedingly difficult even for the trained psychiatric observer to assay the possibilities of adjustment to service conditions in patients with this history of over-protection. Some of them will be able to overcome their handicaps and become useful in the military organization, others will fail to adjust even to the initial demands of the service. In general, however, we know that by far the greatest majority of this type, if they fail, will do so relatively early in their training. It follows that if we devise test situations of service nature we may be able to catch this type earlier than in the past. Such a test situation might conceivably consist of duty under somewhat more rigid conditions than is usual at that point; perhaps with particular emphasis on the observation of the recruit's response to authority and his ability to act rationally in situations requiring independent judgment. These tests do not have to be standardized by any means, and any chief petty officer would be capable of devising appropriate conditions if he were given some understanding of the reasons for the tests.

After the recruit is in the training station where he has to stay several weeks before going on sea duty, there exists the opportunity for a more thorough examination. The Navy has in operation a plan whereby experienced psychiatrists are attached to each training station for such purposes. There are also available trained clinical psychologists and the opportunity to get social service data. With this organization it is hoped that potential psychiatric casualties will be detected.

Among those unfit for military duty are the so-called psychopathic personalities and individuals who by dint of their makeup are unable to adjust realistically to discipline and to group living. Almost every author on military psychiatry emphasizes the fact that military life,

be it in the Army or the Navy, requires a good deal of self sacrifice on the part of the individual. Allow me to quote Heidenhain (10) a German authority on the subject:

> The close confinement of large numbers of men and the battle readiness of the Army require of the individual a considerable measure of punctuality, orderliness, and sobriety. These requirements are new to many soldiers and together with many other demands on his powers of adjustment take a good deal of energy to live up to.
>
> It is in the nature of the thing that these demands are presented to the soldier by his superiors in a very determined, sometimes crude and not very friendly manner. Sensitive, delicate natures, idealistic, dreamy, withdrawn personalities react with fear. Such treatment may provide material for explosions of affect. But it is not only the abnormal personality, but also the well adjusted average person who from time to time has to fight against a feeling of unpleasure in such a situation.

The author goes on to point out the particular conditions created by the demands of unconditional surrender to military discipline and the fact that the soldier has no comeback, as it were, to orders given him.

The emotional tensions built up under such circumstances are considerable. The relatively well-adjusted individual can be expected to weather the storms of conflicting feelings which are bound to blow up at various points during his service. It does take some maturity and power of reflection to understand and accept the necessity for strict discipline and for the maintenance of a certain hierarchy of authority. Even among professional people of mature age we find many who are unable to think in terms of the common weal except when they are allowed to think and act in their own manner. We call them individualists and they are sometimes competent leaders in their own fields. Regimentation to such persons would be odious and rightly so, for civilian life is quite a different matter from military life. The goals of civilian activities are legion. The goals of military activities are few and sharply defined. In no place in civilian life are we quite so dependent upon the individual's doing his allotted part as in the armed forces. Failure of one part of the intricate military organization may spell disaster in a decisive battle. Failure of the psychic organization of the individual is just as dire as failure of the physical machinery.

I have intended these more or less random remarks on the rigidity of military demands and the necessity for faultless function as a basis for a brief discussion of another type of individual dangerous to the service. I refer to the so-called paranoid personality. He is often a person of superior intelligence but one whose essential aggressions and hate feelings toward the world dominate whatever positive and constructive relationships he might form. Although numerically unimportant, this type is both disturbing to the morale and dangerous to the group. He is ruthless, utterly devoid of com-

munal spirit, and bent only on furthering his own ends, regardless
of the consequences to others. His intellectual superiority makes
him even more dangerous.

During the last war a considerable percentage of the casualties con-
sisted of the so-called effort syndrome or "soldier's heart," and various
circulatory disturbances and gastro-intestinal conditions, including
peptic ulcer. These conditions were then regarded as game for the
internist. Today there is an increasing realization that such cases
should be regarded as psychosomatic in nature. That is to say, the
physical symptoms are built on a basis of emotional conflict. It
would take me too far afield to discuss the differential diagnosis be-
tween some of these conditions and conversion hysteria or hypo-
chondriasis which are also characterized by physical symptomatology
on a psychological substratum. Suffice it to say that the psycho-
dynamics of the conversion symptom, the hypochondriacal delusion
and the peptic ulcer are quite dissimilar. They represent entirely dif-
ferent ways of handling emotional conflicts and tensions. The basic
nature of the dynamics in these instances is not clearly understood.
But, and I want to emphasize this, the prognostic implications are
perfectly clear from a service point of view, for our task is to deter-
mine whether a man is or is not fit for duty. If a man develops slight
physical symptoms of a hysterical nature under particularly trying
conditions his prognosis as far as the service is concerned may be
quite favorable. But a true hypochondriacal symptom is a much more
serious affair, for it is indicative of a deeper and in the end more in-
capacitating conflict. The question of diagnostic and prognostic
criteria in the psychosomatic field is one difficult to discuss here. The
field is still new and although we possess much empirical knowledge
no satisfactory theories have been formulated which might allow us to
penetrate further the dimness of our perception of the problem. One
of the results of our future experience in military psychiatry may be
a clarification of this obscure topic. All we can say from our point
of view at the present is that we have enough data on psychosomatic
phenomena to utilize them for prognostic purposes. Experience in
the last war taught us that the effort syndrome was a truly incapacitat-
ing condition which was refractory to any treatment then known.

A discussion of the scope of psychiatry in military medicine would
not be complete without some reflections on the function of the psy-
chiatrist in disciplinary cases. Thirty years ago, the then Passed
Assistant Surgeon Mann (11) of the Navy suggested that "three to
ten percent of the culprits (at Port Royal, S. C.) should be treated
solely by alienists." Whether this suggestion was acted upon, I have
not been able to ascertain but I do know that more thought could be
given to this particular function of the psychiatrists. The French

and the Germans have military courts in which the psychiatrist has a definite function beyond that of determination of "sanity" or "insanity." As a matter of fact Hesnard (12) states that the French Navy had this kind of organization already in 1912. Among the functions of the psychiatrist he lists that of "expert at naval tribunals" and of "military collaborator" to the command. In this capacity the psychiatrist may "eliminate nonvaluable persons temporarily or permanently."

The function of the psychiatrist in regard to naval judicial procedure is one which obviously would have to be worked out by the disciplinary authorities and the psychiatrist. It is not possible for me to visualize the actual procedure because of my insufficient knowledge of the organization, but one might expect it to be somewhat on the same order as that of psychiatrists in juvenile courts. Many disciplinary cases are of a trivial nature, yet a psychiatric investigation, particularly of recidivists, may yield very interesting and useful information concerning the motivation for the delinquent acts. As a matter of fact the psychiatrist already functions in this respect in the Navy although the scope of his functioning is not defined in any official way, and is largely dependent upon his personal discretion and concept of his duties. Sharper formulation of such functioning might lead to a greater efficiency.

In accordance with the basic functional principle of prophylaxis in military psychiatry, there is one problem that remains to be discussed. It is the problem of maintaining the psychic equilibrium particularly under war conditions. Most modern authors, including those who have had extensive experience in the present World War, emphasize the importance of detection and prompt handling of prodromal symptoms of emotional break-down. There are many ways in which the impending frank break manifests itself. A subtle change from a pleasant cooperative disposition to one of irritability, preoccupation with the self, disregard for the interests of others and lessening of interest in the daily tasks may herald the onset of an acute and fulminating neurosis. It is common experience that the incidence of frank neurosis can be somewhat lessened by proper handling in this period of "incubation." If a man exhibiting such a picture is given leave for even a short period, or if he is given a chance to discuss his state of mind with a competent psychiatrist there is some hope that he may be able to return to duty, not only able to carry on but even fortified against future attacks. Even though it is a moot question I should like to stress this phenomenon of "psychic immunization." In the prodromal period there is an opportunity for intensive but brief psychotherapy. After four or five 1-hour interviews the

patient may have learned how important it is to allow the mind a free view of the existing dangers and that even if it is extremely painful to stare reality in the face, it is certainly better than to attempt to ignore its existence.

Because it seems the most controversial field and the one least tilled, I have saved the mention of possible contributions to psychosomatic medicine to the last. Psychosomatic conditions come to the attention of the internist before they are seen by other medical specialists. If the internist has a broad understanding of the problems involved, he will be of invaluable aid in formulating new theories and devising new treatment technics. With the mass of material we are bound to get, it would be surprising indeed if we could not add something to the comprehension of the interrelation between these artificial entities, the body and the mind. The problem has to be investigated from more than one angle but that of the internist remains the primary one.

Even though the task of military psychiatry seems formidable, and even though the circumstances necessitating such a task seem uncivilized and unworthy of our state of culture we may hope for something constructive from wartime experiences. Walter Reed's work under military auspices became a boon to millions of people. In the dim past of the sixteenth century Ambroise Paré laid a foundation on the battlefield for his later contributions to surgery. And if I am not mistaken, Laënnec the inventor of the stethoscope was able to turn his experience as a military physician to good account for coming generations. There is no reason why we should not be able to utilize the psychiatric experiences we may gain in the military field for formulation of extended principles of psychiatry applicable to civilian life as well. I envisage the time, perhaps within a few years, when our increased psychiatric knowledge will lead to far reaching modifications of our handling of young adults as for instance in industry. However, for those of us who are concerned with the application of psychiatry to the military services it is well for the time being to keep these aims in the background and to keep in mind the statement of the mission of the Medical Department of the Navy which appears on the title page of the NAVAL MEDICAL BULLETIN, "To keep as many men at as many guns as many days as possible."

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SURGICAL TIMIDITY

By Captain M. D. Willcutts, Medical Corps, United States Navy

The current expansion in naval activities offers a most stimulating tonic in surgery for the naval medical officer at sea. Independent judgment, decision, and action more and more replaces dependence upon hospital ship or transfers ashore.

Hidden talent in operative surgery abounds. The young medical officer is already trained basically in surgical diagnosis and with encouragement may become rapidly qualified in operative technic.

Emergency surgery afloat requires safe technic for exploring the abdomen, performing an appendectomy, the simple closure of perforations, arrest of hemorrhage from injuries to internal organs, suprapubic cystostomy, suturing of lacerations and severed structures, the reduction and management of fractures and dislocations, and the treatment of head injuries, open wounds and burns. Adequate operative facilities are available on all major naval units. Given surgical talent and the facilities for operating, the immediate task is to dispel surgical timidity. This timidity is based largely upon two factors, forgotten or undeveloped operative technic and anesthesia.

Operative technic to cover the usual emergencies afloat is being developed at naval and civilian surgical clinics.

The anesthetic factor requires more consideration. Faced by an emergency the young surgeon, alone on independent duty, feels awkward, to express it mildly, when choice of anesthesia must also be considered. A sense of futility is engendered, a timidity in decision that destroys action. The youngster does not rate censure. He has attended many surgical clinics but usually the field of anesthesia has been denied him or grossly neglected. Many of the great civilian surgical centers have very poor, if any, concepts of the Navy's need

for training in practical anesthesia. The master surgeon's highly efficient surgical team includes trained specialists, physician or nurse, to conduct this important phase of the operation. Now and then a surgeon-anesthetist is found, the spinal or regional anesthetic is conducted by the surgeon himself, the young officer is duly impressed but usually achieves little practical experience.

He may be first assistant, may function well in diagnosis, pre- and post-operative management of surgical cases, but unless he actually performs a sufficient number of routine general surgical operations and achieves a practical working knowledge of anesthesia he is not prepared to meet the surgical demands afloat today. Surgical timidity may be priceless in the ambitious surgical intern. It is needless to emphasize that respect and appreciation for the operating room is a fundamental surgical law. Today, however, all surgical talent is in demand and full mobilization is necessary.

In the last World War, hospital corpsmen were trained as anesthetists. They have been replaced by graduate Navy nurses who have specialized in anesthesia and are available for hospital ships but not for the surgeon on combat duty. Brilliant advances in the field of anesthesia have ignored the restricted field on the man-of-war. Complex methods in anesthesia requiring collaboration of specialists must be discarded for practical, simple and safe methods. A return to the open-drop method of administering ether and chloroform is definitely indicated.

The hazards of explosion render combustible gases such as ethylene and cyclopropane unsuitable aboard combat ships. Nitrous oxide and oxygen require gas machines and trained personnel, two difficult factors on isolated stations. The soluble barbiturates given intravenously have a definite but limited field for short operations. Morphine, intravenously, suggests a speculative field in anesthesia. For inhalation, ether ranks first in low morbidity but it is irritating, unpleasant, and exciting to the patient and carries definitely known fire hazards. The surgeon may have to call upon lay seamen to administer the ether, a difficult procedure if the patient resists during the induction and excitement stages.

Chloroform is the single important, noninflammable, nonexplosive inhalation anesthetic agent. Despite its well known toxic effects, chloroform in pure form continues to hold an indispensable place in war surgery. For the civilian invalid who faces surgery with vital organs depressed from associated preoperative visceral damage, chloroform is a dangerous anesthetic with proven primary and secondary toxicity. Naval casualties, however, are superior surgical risks, the men are in fighting form, physically fit and hardened. Chloroform is safe to give in any part of the ship and there is no fire

hazard. It is easy to give and is easy to take. If the medical officer is pressed for help, the volunteer seaman may administer the chloroform by the simple open-drop method, the rate always measured by drops, which are counted. Despite the impeachment that chloroform as an anesthetic is too dangerous for use in civilian life, no other agent has yet replaced it for use under naval battle conditions.

The scope of local anesthesia in naval surgery must again be stressed. The surgeon-anesthetist, trained in regional anesthesia will accept all lesions of the head, neck, body, and extremities. Complete field block of the scalp is sufficient for scalp wounds, craniotomy and brain exploration. On the thorax, a combination of paravertebral intercostal block and subdermal infiltration will permit general thoracic surgery. The lungs and heart are not sensitive, the parietal pleura and pericardium, sensitive to traction, may be blocked by direct infiltration of the exposed pleura or pericardium around the operative zone.

For major wounds below the diaphragm, spinal anesthesia is satisfactory in the absence of serious shock or hemorrhage. A combination of abdominal field block and low light spinal analgesia will permit full abdominal exploration. Abdominal field block combined with anterior splanchnic anesthesia induced by direct subperitoneal infiltration will give adequate surgical anesthesia with remarkable relaxation and quietness of abdomen and the greatest safety—ideal for appendectomy.

Local anesthesia is adaptable, extremely satisfactory and safe for all types of fractures and dislocations. Traumatic wounds involving severed tendons and nerves and amputations are excellent cases for the use of local anesthesia.

Given an anesthetic drug such as procaine, one eighth as toxic as cocaine, and yet practically as efficient for all purposes except topical applications, the ideal anesthetic for naval service would seem to have been obtained. The serious handicap is the scarcity of surgeon-anesthetists skilled in the art of administering local anesthesia. The majority of operators, especially the senior and master surgeons in civilian life, have neglected this field of anesthesia and are still dependent upon the old established general inhalation agents when called to the colors. For naval warfare there exist two anesthetic agents easy to master, chloroform and procaine.

With a working knowledge of practical anesthesia, the young naval surgeon's scope of operative surgery widens. He becomes self-sufficient; indecision and timidity are banished. The reserve naval medical officer, called to active duty, finds a new field of surgery surpassing in interest the most active industrial and general field of traumatic surgery.

THERAPY OF GONORRHEA BY THE USE OF SULFANILAMIDE AND ITS ALLIED COMPOUNDS

A REVIEW OF THE LITERATURE AND A REPORT OF 150 CONSECUTIVE CASES TREATED AT THE NORFOLK NAVAL HOSPITAL

By Lieutenant, junior grade, Martin E. Conti, Medical Corps, United States Navy

Since the report of Dees and Colston (1) in May 1937, upon the use of sulfanilamide in gonococcal infections in human beings, there have been many reports of the successful use of this drug in the literature. The results have varied from 40 percent success as reported by Johnson and Pepper (11) of University of Pennsylvania to as high as 90 percent cures as reported by Crean (3) and others.

It is the purpose of this article to evaluate the results of sulfanilamide treatment of gonococcal infections as practiced here on the urological service of the Norfolk Naval Hospital. This report covers 150 consecutive cases seen and treated from October 1, 1939 to February 1, 1940, inclusive.

In the 150 male patients included here the predominating complaint was a urethral discharge, the duration of which varied from 1 day to several months. Gram negative intracellular diplococci were found on smears. Hemoglobin and white blood cell determination of the blood with a differential count was done on all patients before sulfanilamide treatment was instituted. Fifty-two patients had additional complaints such as burning upon urination, frequency, dysuria, pain in and around the perineal region and in a few cases joint pains of various types. Of the total, 23 percent admitted a history of having had a previous gonorrheal infection.

The average time elapsing between the onset of symptoms and admission here at the hospital was, in the uncomplicated or acute cases, of which there were 118 cases or 79 percent, 2 days; in the complicated or chronic cases, of which there were 32 cases or 21 percent, the average time between the onset of symptoms and admission to the hospital was 23 days.

Our method of treatment has consisted chiefly of the following routine where practicable and unless otherwise contra-indicated by reactions, toxic effects of the drugs or other various reasons.

Each case, before treatment was begun with sulfanilamide, was examined, a urethral smear was obtained, and as stated before a hemoglobin, white blood count, and a differential blood count were performed. After the results of our laboratory procedures were reported and, if there were no contra-indications to treatment such as evident blood abnormalities, the drug was administered as follows: 120 grains were given within the first 24-hour period, followed by 80 grains daily for the next 3 days and then the dosage was reduced to 60 grains daily until a beneficial or nonbeneficial response was noted. However, at no time was the drug given for a period exceeding 14 days consecutive therapy. Appropriate doses of sodium bicarbonate were given simultaneously with the sulfanilamide.

All doses were given at 4-hour intervals, in accordance with Long and his coworkers who have more or less definitely established that the drug appears to be more effective at 4-hour intervals of administration. On the morning of the fourth day of administration of the drug, a repeat hemoglobin and white blood count were done to determine whether or not there were any toxic effects on the bone marrow with resulting abnormalities of the blood picture such as leucopenia or anemia. Unfortunately, blood sulfanilamide determinations were not available to us routinely and we are unable to state or note the levels at which the optimum beneficial results were obtained. In this respect, according to Marshall (4) the blood level of sulfanilamide to be desired is approximately 10 milligrams. Each case was seen daily and occasionally the dosage of the drug was altered wherever it was deemed necessary to do so, depending upon the individual case. All the patients were kept in bed the majority of the time during the administration of the drug and saline cathartics were entirely forbidden.

If, after the administration of sulfanilamide for a period varying from 7 to 14 days, no beneficial response was noted, it was classed as being ineffective and a failure, and the patient was placed on some type of local therapy to the urethra consisting of either injections of protargol or anterior irrigations of a 1–12,000 solution of potassium permanganate either alone or sometimes in conjunction with the sulfanilamide.

The average number of days during which sulfanilamide was administered was only 6.2 days in contrast to the longer period of 21 days as heretofore practiced.

The average total dosage of the drug given was 641 grains or 42.7 grams per patient.

The average period of hospitalization including all cases, acute and chronic, and those exhibiting complications upon entry to the hospital, was only 22 days in contrast to average of a little more than 30 days in the period prior to the advent of chemotherapy of gonococcal infections by means of sulfanilamide. It has generally been proven by most writers on this subject that since the use of sulfanilamide, the period of hospitalization has been decreased and Crean (3) states emphatically in his article that it has reduced the hospital days by one-third. Our results seem to bear this statement out also.

Complications.—The progress of patients under therapy is by no means uniform as shown by the fact that some patients exhibit amazing therapeutic results in a relatively short time while others do not show a similar response and in a few instances, complications are encountered while under active therapy with the drug. Of this latter group, there were 12 cases or 7.5 percent who developed some complication while under active treatment with sulfanilamide. Of these 12 cases, 8 were infections of the epididymis, 2 were acute trigonitis and posterior urethritis with terminal hematuria, 1 developed a periurethral abscess and 1 an infection of the joints.

Sulfanilamide did not seem to prevent the complication of epididymitis and in this series of cases, it also proved ineffective as a treatment of this and other complications, such as prostatic and joint involvement.   It is of interest here to note that one of the cases included herein developed a gonorrheal opthalmia during the administration of the drug for his urethritis.   Fortunately, this complication was recognized immediately and under appropriate treatment was controlled and the eye was saved.   Of the known 32 cases that presented a complication upon entry here, only 3 percent were benefited by the drug.   This finding is in contrast with most observers who report almost as beneficial results in the chronic as in the acute cases.   Most writers also are agreed that the use of sulfanilamide has reduced the incidence of complications and despite the 7.5 per cent we encountered in this service, we are in accord with this fact.

Results of Treatment.—In the so-called uncomplicated or acute cases upon admission here, our results, although not as spectacular as some of the results published in the literature, have shown that 90 cases or 60 percent were apparently cured clinically and able to return to duty as there was no apparent discharge or symptoms noted prior to their return to duty.   These results are in accordance with those of most writers on the subject and would therefore seem to justify the continued use of this drug or some of its allied compounds in the treatment of gonococcal infections.   In 7 percent of the cases there was moderate improvement noted and these resulted in cures with the aid of some local therapy to the urethra as previously outlined above.   There were 49 cases or 32.5 percent who exhibited no response whatsoever to the drug and these are all classified as failures.   The majority of this group were treated by means of irrigations and injections, and subsequently were returned to duty.   Of this group of failures there can be no doubt that approximately 10 percent can be attributed to an early toxic reaction from the use of the drug.   In 6.6 percent, 10 cases, there was a recurrence of the discharge and symptoms and the patients were returned here for further therapy.   Four percent of these cases cleared up with a second course of sulfanilamide.   As there has been no complete follow up in these cases after discharge to duty, it must be assumed that perhaps there must be another 4 or 5 percent of recurrences not accounted for in this report thus making the early relapse and recurrences about 10 percent.

Reasons for failure.—The reasons for failures in a certain percentage of cases is not entirely clear.   No doubt toxic reactions in a certain number of cases causes a temporary or permanent withdrawal of the drug with a resultant fall in blood concentration of sulfanilamide to a lower level than that which is necessary for the proper

therapeutic result. Insufficient amount of the drug, or too short a time period of its administration are also likely reasons for failure. In a small number of cases, poor cooperation of the patient is responsible. According to Crean (3), he observed that robust, healthy individuals seemed to tolerate and obtain a better result than the asthenic, underweight type of patient. We have not noted this finding but have noted that the colored patients under our care seemed to have a greater tendency to benefit sooner and more completely than our white patients. The reason for this has not been established but perhaps is due to a better cooperation noted among the colored group as compared with the white patients.

Criteria for cure used were: (1) Absence of symptoms and discharge; (2) negative smears; (3) passage of sounds with gentle massage of anterior urethra; (4) absence of shreds as shown by the 3 glass urine test; (5) prostatic examinations.

Reactions.—The usual types of reactions common to sulfanilamide therapy were encountered. The percentage of reactions noted in this series of cases was 18.7 percent. This compares favorably with the percentage noted by other observers; in fact, might be considered somewhat higher than most writers due to the fact that in this series of cases the period of sulfanilamide therapy was only 6.2 days in comparison with an average of 14 to 21 days, as given by others. These reactions consisted chiefly of lassitude, dizziness, nausea, vomiting, rise in temperature, cyanosis, various skin eruptions and even a leucopenia in some cases. Although no serious reactions were noted in our series of cases, there have been reported in the literature cases of sulfhemoglobinemia, acute hemolytic anemia, optic neuritis, and agranulocytosis and peripheral neuritis (7). Upon discontinuance of the drug the reactions noted subsided rapidly and in only one case did a skin rash persist for a period of 7 or more days. One case of jaundice was noted and this cleared up rapidly upon withdrawal of the drug.

Mode of action of the drug.—The exact mode of action of sulfanilamide upon gonococcal infections has not been determined as yet. There are two schools of thought in this regard. One is that the proper concentration of the drug in the urethral tissue itself produces an initial bacterio-static effect with a subsequent mobilization of local immunity factors. The other theory is that it is the concentration of the drug in the urine which has the therapeutic effect. It is the opinion of most observers that the former plays the more significant role. The gonococcus seems to become ingested intracellularly under the influence of sulfanilamide.

In May 1938, approximately 1 year after sulfanilamide had been introduced to the medical profession and general public, Pelouze (8),

in an article read before the Neisserian Medical Society meeting held in Washington, D. C., warned against the then too enthusiastic reports concerning this new drug, stating that although he realized a great advance had been made in the treatment of gonorrhea by the use of sulfanilamide, by no means had we found the cure-all as first proposed by some members of the medical profession. He also warned that we should not forget some of the principles used in the treatment of this disease before the advent of sulfanilamide; such as the priceless ingredient of strict cooperation on the part of the patient and avoidance of alcohol and sexual excitement. With these entirely fundamental principles as annunciated by Pelouze, we are in deep accord. Since the use of sulfanilamide, the determination of a cure has been increasingly uncertain due to the effect of the drug in causing the gonococcus to become ingested intracellularly, a phenomenon that never occurred in the old days. Thus we see that better methods of laboratory work such as cultural studies will be necessary before a cure can be established definitely. It would seem that if the drug acts favorably upon the disease, the patient is almost or entirely symptom free by the end of 5 to 7 days. This fact has been substantiated also in our series of cases. We must guard against the false sense of security that this new drug has given many patients suffering from this disease, for if they have been told that they were cured, they will return to normal sexual activities and thereby cause a greater spread of the disease. This phase of sulfanilamide therapy has as yet not been sufficiently emphasized.

Listed below is a table of results of sulfanilamide therapy of gonorrhea in the published case series, and to which has been added this series of cases.

TABLE 1.—*Results of sulfanilamide treatment of gonorrhea in published case series*

Author	Number of cases	Percent of of cures	Author	Number of cases	Percent of cures
Dees and Colston [1]	47	75	Orr	134	87
Reuter [2]	100	90	Ferguson et al [11]	298	76
Herrold	30	50	Silver and Elliott [12]	1,625	60
Erskine, Johnson et al	100	(*)	Potter	225	35
Creen [3]	100	90	Conti	150	60
Johnson and Pepper	64	40			

*Early improvement.

It is interesting to note that in the largest series of cases reported in the above table, the percentage of cures obtained in our series was comparable in that they also reported 60 percent cures.

Even the most conservative consideration of the majority of these consistently uniform results confirms the statement that the use of sulfanilamide is of unprecedented efficacy in the control and cure of

gonorrhea. However, there is an inherent danger in the use of this drug, especially where there will be cases of self-administration. In loss of work perhaps gonorrhea ranks second only to the common cold. In the naval service where we are interested in obtaining a cure with our patients as soon as possible and thus returning them to duty, this question of the morbidity and treatment of gonococcal infections is one of paramount importance. It is my opinion that sulfanilamide and its allied drugs must be considered in the same light as the arsephenamines, namely, of unparalleled value in the control of a widespread and highly communicable disease like gonorrhea. However, it is a drug which demands caution and intelligence in its use and which, if properly used, should aid in the solution of what has been and still is a most trying problem from both an individual and a social point of view as well as concerns those of us in the naval service who are engaged in the treatment of this modern scourge.

At this point I would like to review some of the results obtained and reported in the literature concerning the use of the allied compounds of sulfanilamide in the treatment of gonococcal infections. In this connection I might state that the following discussion will of necessity be limited to other observers' results.

SULFANILYL-SULFANILAMIDE

More recently there have appeared reports in the literature on the use of this drug in gonorrhea, the results of which have been rather phenomenal as reported by O'Crowley, James, and Sutton (9) in a series of 85 cases in which they have reported 95 percent cures in 10 days as compared with only 58 percent cures in 21 days by the use of sulfanilamide. They are also of the opinion that this drug is less toxic and 50 percent more effective than sulfanilamide. Shelley, in a report covering 100 cases, reports only 3 failures. Walzak (6) in a report of 36 cases, reports 83 percent cures in 7 days. He also reports better results with this newer derivative (disulon) with less dosage using only 22 grams over a period of 14 days in comparison with 68 grams of sulfanilamide over a period of 28 days and with only 68 percent cures. From these reports it would seem that this drug has very good anti-gonococcal potency and therefore, is worthy of being given a trial.

In the past several months, the sodium salt of sulfanilyl-sulfanilamide has been used with consistently good results although in comparison with the sulfanilyl-sulfanilamide, James and Sutton (10) reported slightly less cures (83 percent) and a longer period of time for cessation of the discharge and clearing of the urine. They found the complication rate also a little higher with the sodium salt of the

sulfanilyl-sulfanilamide. However, they report that 10 cases that were failures with sulfanilyl-sulfanilamide recovered under therapy with the sodium salt of sufanilyl-sulfanilamide. These facts only bring into view the meagerness of our knowedge of the biology of the gonococcus and perhaps some day we may arrive at the stage where in gonorrhea, like in pneumonia, a rapid method of determining the strain of the organism involved may be found. This would certainly be a long step towards the final goal in the treatment of gonorrhea.

SULFAPYRIDINE

In reviewing the literature it is found that the trend of therapy in gonococcal infections has deviated rather rapidly in the past year or so towards the almost exclusive use of the more recent derivatives of the sulfonamides, namely, sulfapyridine and sulfathiazole. Johnson, Leberman, and Pepper (11) in November 1939 reported 77 percent cures in a series of 80 cases treated with sulfapyridine as compared with only 40 percent cures obtained with sulfanilamide therapy at an earlier date. However, they noted that sulfapyridine as compared with sulfanilamide appeared to be more toxic with 56 percent of their cases exhibiting some type of toxic reaction. This is exceptionally higher than the percentage of reactions observed in our series of cases. A general tendency to a more marked toxic effect on the bone marrow with a resultant lower hemoglobin, and more marked leucopenia was also noted in their cases. From this report, it would seem that we must be more cautious in the use of sulfapyridine although other observers have stated that the toxic reactions resulting from the use of sulfapyridine are of a mild nature. In this respect, I might mention here that severe fatal reactions from sulfapyridine have been noted and I have witnessed such a case which has been made the subject of a separate report.

In a comprehensive review of the entire subject of gonorrhea published in Venereal Disease Information Bulletin, Young (14) and his associates of the Johns Hopkins Hospital stated that they were convinced of the efficacy and great value of sulfanilamide and its derivatives in the treatment of gonorrhea. He definitely warned, however, that careful observation of the patients should be instituted. He was more enthusiastic over the results obtained by the use of sulfapyridine and sulfathiazole than those obtained from the use of sulfanilamide. In some recent laboratory studies conducted by Hill, upon the effect of the sulfonamide group of drugs on the growth curves of bacteria in urine, she has shown that the greatest antibacterial action was obtained with sulfathiazole, followed by sulfapyridine. Owing to this fact and to the less toxic effects obtained in sulfathiazole therapy,

Young concludes that it seems very probable that sulfathiazole will become the drug most highly favored in the treatment of gonorrhea and its complications.

Mahoney, Wolcott, and Van Slyke (15) in a report of 200 cases of gonorrhea treated with sulfapyridine obtained 79.5 percent cures. They noted a very rapid subsidence of symptoms and disappearance of the urethral discharge in an average of 2.5 days. Dosage employed was 6 grams per day for 2 days, followed by 3 grams per day for 4–6 days and the drug was administered at 4-hour intervals. Of this group of cases, 136 had failed to respond to attempts at treatment with sulfanilamide. Of these, 75.7 percent were apparently cured by the use of sulfapyridine. These observers, in contrast to others, also reported less frequent and less severe toxic reactions from the use of sulfapyridine as compared to sulfanilamide.

Pelouze (16) (17) (18) again calls attention to the fact that much of the problem of treating gonorrhea remains exactly as it was before the advent of the sulfonamides. He is of the opinion that there is the same need for an understanding of the disease itself and stresses that the one "priceless ingredient" of all curative effort is the cooperation of the patient. He also states that no discussion on this subject would be complete without the warning that these drugs bear toxic possibilities. This warning is very timely, in that, as stated above within the past year I personally have witnessed a case of severe, fatal, granulocytopenia resulting from the use of sulfapyridine in the treatment of an acute urethritis. He warns that much of the toxic picture could be eliminated if the medication is stopped just as soon as it was obviously failing to produce a cure or as soon as any toxic reaction occurs. He has noted that practically all favorable cases are usually symptom free by the end of the fifth day or thereabouts, and advocates that any patient who is not almost entirely symptom free then, should be classed as a failure and the drug discontinued. He states also that those people who are treating this disease should do well to avoid the impression that all is "moonlight and roses" even as we turn to the newer sulfonamides, for they too, like their predecessor, sulfanilamide, produce some asymptomatic carriers who are now beginning to return to the dispensaries and various clinics, patients whom we were sure were cured some months previously. On the other hand, he concludes that despite failures, remissions, etc. the apparent cure rate of 70 to 90 percent for both sulfapyridine and sulfathiazole—that any such drug, which will within two weeks cure such a percentage of patients, has human values far beyond our powers of expression.

Moffett (19) in a series of 104 cases of gonorrhea in women reports 87.4 percent cures. She also used, in addition to sulfapyridine, a 10

percent protargol application to the urethra and cervix daily. The chief toxic reactions noted in this series were nausea, headaches, and skin eruptions. No major toxic manifestations were noted. The dosage employed was 0.5 gram four times daily for 7 days.

Marinkovitch (20) and many other observers all report favorable cures varying from 75–90 percent and conclude that (M & B 693) or sulfapyridine is the most potent antigonococcal agent available at this time.

SULFATHIAZOLE

Since the report of Pool and Cook (21) in their paper on urinary tract infections presented one case of gonorrhea which was cured by the administration of sulfathiazole, there have been many very favorable reports being published upon the use of this newer and most recent derivative of the sulfonamide group against gonococcal infections. Among the early reports in this country in the treatment of gonorrhea by the use of sulfathiazole is that of Culp (22) of the Johns Hopkins Hospital. In a series of 38 cases he reported a cure of 81 percent and concluded that this drug was of the greatest value in the treatment of acute gonorrhea, and compared very favorable with sulfapyridine. Mitchell, Greig, and Uren (23) in a series of 65 cases report cures as high as 84 percent in period of 5 days. Lloyd and Erskine (24) of Guy's Hospital, London, England, investigated sulfathiazole and also sulfamethylthiazole and noted a very rapid response to treatment and practically no evidence of any toxic manifestations. The dosage used in this series consisted of 4 grams daily for 5 days and the results obtained, especially with sulfathiazole, were very favorable.

In a series of 45 cases treated with sulfathiazole, Ballenger (25) and his coworkers reported very optimistic results and observed that sulfathiazole was as effective as sulfapyridine and less dangerous to use. They noted that the toxic reactions to administration of the drug were fewer and less severe than those encountered with either sulfapyridine or sulfanilamide. However, despite the mildness of these toxic reactions, it should be remembered that careful supervision of the patient is just as necessary during its administration as it is with other sulfonamide preparations.

Mahoney, Wolcott, and Van Slyke (26) in a series of 115 cases of gonorrhea in males, obtained 79.1 percent cures by the use of sulfamethylthiazole. Dosage used was 4 grams daily in 4 divided doses the first day, followed by 2 grams daily for 6 to 9 days. In women, the dosage used was 3 grams daily for 1 day followed by 2 grams daily for 6 to 11 days. In 19 of the 21 cases of women treated, there was a complete disappearance of all clinical evidence of disease,

negative smears, and negative cultures. They concluded from these observations and study that this drug is efficacious in the treatment of patients who have not received any previous chemotherapy but less so in those patients who have failed to obtain cures from the previous administration of sulfanilamide. The toxic manifestations are usually mild but a number of observers have noted that the drug has apparently served as the etiologic basis in the production of peripheral neuritis, a serious and disabling complication, therefore, they do not recommend its use in the routine treatment of gonorrhea. In a series of 105 male patients treated with sulfathiazole, these authors noted a cure rate of 91.5 percent which is among the highest to be reported. They found that larger doses of 8 grams for 1 day followed by 4 grams for 6 to 8 days did not appear to be more effective than the smaller dosage employed, i. e., 4 grams for 1 day followed by 2 grams for 6 to 9 days. The duration of the infection before instituting chemotherapy by means of sulfathiazole did not appear to influence the therapeutic response. Mild toxic reactions consisting of transitory malaise, vertigo, and headache were recorded in only 6 cases of this series. They came to the conclusion that this drug appears to be the most commendable agent yet used for treatment of gonococcal infections, not only because of its high degree of therapeutic efficiency but also because of the lack of toxic effects noted in the dosage employed.

Blaekstone and Hicks (27) in a series of 30 cases treated with sulfathiazole and followed for a period of from 6 weeks to 7 months report very favorable results. Toxic reactions were noted in only 3 cases of this series.

Greig, Uren, and Mitchell (28) in a second report on the value of sulfathiazole in the treatment of gonococcal infections, treated a series of 102 cases and obtained 92.5 percent cures. They, too, reported only a few mild toxic reactions to the drug. In a comparison study of the various sulfonamide drugs in the treatment of gonorrhea, these authors obtained a greater percentage of cures with the use of sulfathiazole than with any of the previous drugs used. They therefore concluded, that at present, sulfathiazole is the most potent drug available in the armamentarium of drugs used in combating infections of gonococcal origin.

CONCLUSIONS

1. Of 150 cases of gonococcal infections in hospitalized males treated with sulfanilamide, 60 percent can be classed as cures.

2. In successful cases, the discharge and symptoms usually disappeared within 10 days, some cases in as early as 4 to 5 days.

3. Of the acute or uncomplicated cases, 60 percent were cured. Of the chronic or complicated cases, only 3 percent were benefited.

4. Sulfanilamide therapy in successful cases reduces the period of hospitalization. In this series it reduced the period from over 30 days to 22 days.

5. Six and six-tenths percent of cases showed an early relapse.

6. In the cases not benefited by sulfanilamide, local therapy to the urethra as an adjunct to sulfanilamide proved beneficial.

7. Sulfanilamide therapy has benefited the course and treatment of this series of cases. However, other established time-tested methods of therapy will continue to have a role.

8. Toxic reactions occur, some even resulting fatally. However, these are rare. In this series, 18.7 percent of cases exhibited a toxic reaction.

9. The reason for failure of the drug in about one-third of cases, has not been determined.

10. Although some observers have reported good results in chronic cases, our series showed only 3 percent cures.

11. Adequate dosage should be maintained during treatment. Hospitalization is the ideal method to insure adequate dosage and close supervision of the patient.

12. Sulfanilamide, the first of the sulfonamides to be used in the treatment of gonococcal infections, has now been largely discarded in favor of the more recent of these drugs.

13. Sulfapyridine is an efficient anti-gonococcal agent but does not produce toxic effects of great magnitude in some cases.

14. Sulfapyridine produces a greater percentage of cures than its predecessor, sulfanilamide.

15. Sulfathiazole produces a greater percentage of cures than either sulfapyridine or sulfanilamide.

16. Sulfathiazole produces the least severe and least number of reactions of any of the sulfonamides.

17. Sulfathiazole, according to the most recent reports, is the greatest drug value at our disposal in combating gonorrhea.

18. However, as Pelouze warns us, these drugs are by no means infallible and older methods such as cooperation of the patient, avoidance of alcohol and sexual stimulation still remain important factors in the proper treatment of this still very prevalent and highly communicable disease.

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ROUTINE BLOOD KAHN REACTIONS

REPORT OF 9,434 TESTS MADE ON MARINE CORPS RECRUITS

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This report is based on 9,434 routine blood Kahn reactions of recruits entering the recruit depot, United States Marine Barracks, Parris Island, S. C., between January 1, 1940, and December 31, 1940. It is offered in supplement and for comparison with the findings reported on 10,000 blood Kahn tests made on naval recruits entering the United States Naval Training Station, San Diego, Calif., between July 1939 and July 1940.

The recruit personnel on whom this report is based entered the service from all States east of the Mississippi River.

The interpretation of results of all tests in this series was made in conformity with instructions contained in "Serology Notes," an instruction manual of the United States Naval Medical School, Naval Medical Center, Washington, D. C.

The blood Kahn tests of the entire series of 9,434 cases here reported were made prior tó cowpox inoculation and typhoid vaccination in contradistinction to the 10,000 cases reported in the San Diego group which were reported as having been made following cowpox inoculation and typhoid vaccination.

A total of 20 persistent positives, 19 varying from 2 plus to 4 plus interpretations and confirmed by repeat tests at variable intervals, and 1 with a persistent 1 plus interpretation, also confirmed by repeat tests, was obtained in the entire series of 9,434 cases. This is an incidence of 0.21 percent as compared to the San Diego series with a reported 12 cases for an incidence of 0.12 percent persistently positive reactions. As in the San Diego group, there were no other physical findings in the group of men showing persistently positive blood Kahn reactions that would indicate their reactions as being due to any disease other than syphilis. One recruit of this group admitted knowledge of having contracted syphilis three years prior to enlistment and further admitted that he had received only limited and inadequate treatment. All recruits of this group were discharged from the service by reason of inaptitude (physical disqualification existing prior to enlistment) in accordance with direction of the Major General Commandant, United States Marine Corps.

Aside from the above mentioned 20 recruits with persistently positive blood reactions, there were in the entire series only 5 temporarily positive blood Kahn reactions, none of which were interpreted as more than 2 plus, and all were, on repeat tests made within 48 hours of the original positive, proven to be negative. These 5 cases were classified in this series as false positives. They comprise an incidence of 0.053 percent of the entire series and represent a marked decrease of incidence in comparison with the San Diego group with a reported 26 false positives, definitely classified as such on the basis of not returning to negative under 3 to 4 weeks. This is an incidence of 0.26 percent and does not include 16 reported weakly positive or doubtful Kahns of the San Diego group which became negative within a day or so after the weak positive. There were no cases in this series which, as reported in the San Diego group, remained positive for 3 or 4 weeks after the original positive and then returned to negative.

Due to the fact that all tests reported in this series antedated both cowpox inoculation and typhoid vaccination, no proper conclusion based on demonstrable evidence of the probable effect of these procedures on the blood Kahn reactions can be drawn as was done in the San Diego report. However, the very appreciable decrease in incidence of the reported false positives, by any classification, in this series, the interpretations of which were not influenced by either cowpox inoculation or typhoid vaccination, gives considerable support, through negative evidence, to the conclusion of the San Diego report that cowpox inoculation does have some effect on the diagnostic Kahn test.

It is therefore offered that, at least until all doubt is dispelled through further investigation as to the possible effect upon the diagnostic Kahn test of cowpox inoculation or typhoid vaccination or both, these procedures could be prudently withheld in the case of recruit examinations until the blood Kahn reaction has been determined.

THE TREATMENT OF NERVOUS AND MENTAL MANIFESTATIONS OF THE ALCOHOLIC

By Lieutenant E. L. Caveny, Medical Corps, United States Navy

The subject of alcoholism is a very broad one and covers a wide range of manifest symptoms, varying from mild nervousness to raving mania. A discussion of alcoholism as a whole will not be attempted and symptoms of the various alcoholic states will be touched upon only as treatment applies. The primary purpose at this time is to discuss the treatment of alcoholism in cases with definite mental manifestations or neurological signs, such as delirium tremens, alco-

holic psychosis, Korsakow's psychosis, and the various forms of neuritis.

During a normal tour of duty on the neuropsychiatric service of the Philadelphia Naval Hospital a large number of alcoholics, in all stages, are seen and treated. Not only are there a large number of alcoholics admitted outright to the neuropsychiatric service, but also a large number are drawn from the other services throughout the hospital. This latter source of patients is readily explained by the fact that mental and nervous disorders frequently occur in the habitual and chronic alcoholics following injuries, operations, and acute infections. The actual etiology of why these disorders appear so frequently at such times is unknown. However, they are not caused by the abrupt withdrawal of alcohol as will be shown later.

Until a few months ago, the treatment at this hospital was the commonly used one of dehydration and spinal drainage. This form of treatment was based on the fact that at autopsy in cases of delirium tremens cerebral edema was frequently found. The treatment was not considered satisfactory for a number of reasons. The period of hospitalization was frequently prolonged, the mortality rate was considered high, and there were certain conditions usually present which were not being treated, such as dehydration, toxicity, and avita-minosis. Alcoholics frequently have these conditions, and alcoholic disorders usually occur as a result of a prolonged debauch in a chronic alcoholic, during which time the patient has had insufficient food, fluid, and rest. While this department was attempting to establish a more desirable form of treatment in these cases an article appeared in the Journal of American Medical Association, April 1, 1939, "The Treatment of Delirium Tremens," by Bowman, Wortis, and Keiser, all of the psychiatric department of the Bellevue Hospital, New York. This article took into consideration all the manifest conditions, secondary to alcoholism, which were going untreated by the dehydration method.

Along lines similar to those advocated by the above authors, a new method of treatment was instituted on the neuropsychiatric service of this hospital and, with minor variations, has been continued up to the present time. The results have been extremely gratifying and a brief résumé will be given of cases so treated in conclusions.

The treatment now followed is to force fluids, emphasizing a high caloric, and high vitamin intake. It may be stated that this form of treatment, with few variations, will satisfactorily fit all types of alcoholic disorders and manifestations.

Alcohol is immediately and completely withdrawn. It is interesting to note that frequently in the prodromal period of delirium tremens a distaste for alcohol is sufficient to cause an abstinence for

several days. Because of the gastritis and particularly the hepatitis which so many of these patients have, it is impossible for them to retain anything by mouth, even alcohol. This type of reaction or abstinence is often mistakenly considered as a cause rather than a result of delirium tremens. Various studies have shown conclusively that 75 to 90 percent of patients have alcoholic mental and nervous disorders while still drinking. There is no basis for the administration of alcohol either for prevention or as a subsequent therapeutic measure. It must be remembered the delirium has had a prodromal period of several days, and that one of the symptoms may be a distaste for alcohol.

Delirium tremens is frequently aborted if recognized and treated in the prodromal period. Thus it is well worth while to briefly give the symptoms commonly seen in this period: nervousness, restlessness, tremours, anorexia, disturbed sleep and insomnia, especially in a patient with a history of chronic alcoholic indulgence.

Restraining the patient is unnecessary and is gradually being abolished. It has been unnecessary to restrain any patient on this service. By restraining a patient the dehydration and exhaustion which is already present will be increased in his attempt to free himself.

Sedation plays a very important part in the treatment of alcoholic disorders. This method includes high enemas and hydrotherapy. High enemas, preferably magnesium sulphate (MgSO$_4$ oz. 3, glycerin oz. 2, mineral oil oz. 1, in water oz. 10 to 12), are routine at the onset, both for the relief of constipation. which these patients usually have, and for the definitely quieting effect they have on the disturbed or overactive patient. Hydrotherapy in the form of a continuous tub bath is advocated in acute delirious states if the patient's temperature is not over 100.5° F. Sedative medication is as a rule necessary. Morphine is not to be used. This drug not only increases the intracranial pressure but will frequently mask associated intracranial and intra-abdominal injuries. Bromides are much in disrepute and are to be used with caution if used at all. The rapidity of elimination of this drug, as well as its toxicity, varies greatly in different individuals. Also, the amount of this drug previously administered is frequently unknown. A number of cases of bromide-psychosis have been treated on this service, the symptoms of which will mask the picture of these disorders. The drug of choice, and the one that has been used exclusively by this department, is paraldehyde, because this drug is felt to be less toxic, more rapidly eliminated, and most uniformly effective. This drug is given by mouth or rectum in doses of drams 2 or 3 in water and repeated as necessary until desired sedation has been obtained. Frequently it is found that the patient will refuse the first does of paraldehyde and that it be-

comes necessary to give it per rectum, but it is also found that he will rapidly take all subsequent doses.

Lumbar punctures are never performed for specific treatment in alcoholic patients and should only be done as a diagnostic procedure when other conditions are suspected of being present.

A careful history and physical examination should be routine in all cases of alcoholic disorders. The importance of this procedure is readily seen, since it is so well known that the prognosis of cases of alcoholism with neurological and mental disorders are adversely affected by the presence of precipitating and complicating factors. Therefore, working in close cooperation with the medical and surgical services is advantageous and patients who fail to respond satisfactorily to treatment should be seen in consultation with these services.

All alcoholics have a varying degree of deranged metabolism. After the above preliminary details have been done and the patient quieted, the problem of reestablishing the patient on a normal metabolic basis presents itself. As shown by Bowman, Wortis, and Keiser, it is definitely known that alcohol markedly decreases the oxygen consumption of the brain, presumably like all narcotics, by displacing the metabolites present on the surface of the brain. As dextrose is the main nutritive for the brain, and as this material is not available in delirium states, it is quite necessary that it be supplied in these cases. This carbohydrate is available in many forms but orange juice is used because it is easily obtained, the patients like it, it is readily digestible, and, in addition, furnishes vitamin C. Also, as there is some liver dysfunction present in alcoholics, this carbohydrate undoubtedly helps to correct the deranged metabolic processes thus involved.

Chemical studies of the blood chlorides should be made whenever practicable. On this service the chloride estimation is obtained on admission and frequently found to be low, usually between 400 and 470 mgm. per 100 cc. of blood. In cases of alcoholic delirium there is a retention of carbon dioxide and an accumulation of lactic acid in the blood, thus diminishing the alkali reserve of the body, and in turn giving rise to an acidosis. The administration of the sodium ion not only helps to combat dehydration, but successfully combats the acidosis. In all cases in which the blood chloride estimation is found to be below normal, sodium chloride is given in enteric coated capsules, grs. 10, every 4 hours.

The diet requires supervision and considerable attention. Vitamins are considered a part of the diet and all people who eat a fairly wide variety of foods will have no lack of them. However, it must be remembered that the diet of the alcoholic is grossly deficient. Vitamins, individually, will be discussed later. The diet should be soft at first, rich in vitamins and contain from 3,000 to 4,000 calories. Fre-

quently at the onset there may be anorexia and, unless persuaded or forced, the patient will eat very little or nothing. This type of patient requires close supervision in that someone will have to stand by and assist during meals to see that he eats all of his food. It is felt that food frequently acts as a sedative on a disturbed patient. Tube feed if absolutely necessary. The hospital soft diet is rich in vitamins and has a high caloric content and is usually prescribed for the first 3 or 4 days, following which, if patient is relatively free from gastric upset, a regular diet is prescribed. Occasionally an alcoholic is unable to retain anything by mouth for the first day or so. In such cases, intravenous saline and glucose should be given.

As the alcoholic has had, as a rule, deficient food, and as the complicating infections make the prognosis bad, the importance of vitamin therapy cannot be overemphasized. Recently, it has been well established that vitamins A and B play an important part in the metabolism of the nervous tissue. In the series of alcoholics on this service there has been a high incidence of peripheral neuritis, showing a deficiency of vitamin B_1. This vitamin is given intramuscularly or intravenously in doses of 6,000 to 10,000 units once daily for the first 7 to 10 days. Thereafter it is given by month, 5 mgm. two or three times a day. Studies have shown that there is a subnormal amount of vitamin C in the blood stream of patients with delirium tremens, while this is not true of even severe chronic alcoholics without neurological and mental changes. As previously stated this vitamin is amply supplied by giving orange juice, which in addition supplies the necessary dextrose. Vitamins A and C play an important part in combating infections, as has been shown by experiments. Vitamin D is given in the form of viosterol, min. 10, twice daily. Brewers' yeast tablets, 4, three times a day, not only supplements vitamin B, but also supplies vitamin G, or the B complex. Nicotinic acid, also part of the B complex, should be withheld for the first few days of treatment because as a rule these patients do not tolerate this vitamin very well during this period. After the first 3 or 4 days this vitamin is then given in large doses, 500 to 900 mgm. per day in divided doses, 50 mgm. every 2 hours and 100 mgm. with each meal. If the patient reacts or shows an intolerance, such as excessive flushing or hyperemia of the skin, itching, or rash, the amount should be reduced and later gradually increased again. Nicotinic acid has been found less likely to produce a reaction if given in solution of normal saline, 100 mgm. in 250 cc. solution. Vitamins are not a cure-all and the addition of vitamin supplements to a normal diet is of no value, in the absence, of course, of disease or a previously inadequate diet. Whenever there are signs of a specific vitamin deficiency, as B_1 in peripheral neuritis, there is usually a multiple vitamin deficiency and the case should be

so treated. It will be noted that all vitamins are given in comparatively large doses which will be ample for therapeutic response. That portion which is not utilized will be readily eliminated without harm. If there is no response to adequate vitamin dosage within a few days, there is little need to continue this particular treatment and medical consultation should be requested.

The toxicity and dehydration, which are invariably present in delirious states, are successfully combated by giving fluids from 3,000 to 4,000 cc. per day. An attempt to limit fluid intake because of signs pointing to associated cerebral edema is short-sighted. It is felt that fluid itself acts as a sedative. However, there are causes for exception to forcing fluids, such as cardiac failure and nephritis with edema. If necessary the fluids should be given intravenously in the form of saline with 5 percent glucose.

Psychotherapy is to be given due consideration in these cases, particularly those with mental disorders. The psychogenic factors play an important part in the clinical picture and varies considerably according to the personality of the patient. He should be placed in a normal environment as his mental condition will permit, and nursing personnel should be shifted as little as possible. Reassure the patient frequently that he has nothing to fear and that there is no true basis for his hallucinations.

COMMENT AND CONCLUSIONS

A new method of treatment of alcoholics with mental disorders and nervous manifestations has been presented. This method takes in consideration conditions usually present in the alcoholic which are frequently overlooked or go untreated, such as dehydration, avitaminosis, and toxicity. This method has been used extensively in recent months at the Philadelphia Naval Hospital and has proven quite superior to other forms of treatment. With minor variation this method was found to be equally successful in the treatment of all types of alcoholic disorders and manifestations. It should be stressed that a careful analysis of the patient's physical condition be made, and if any evidence is present of congestive heart failure or nephritis with edema, the forced fluid should be withheld.

The success of the above method of treatment will be readily seen in the following brief résumé of the first 100 cases so treated. All cases included in this group revealed definite evidence of a nervous manifestation or mental disorder, frequently a combination of the two. These cases likewise presented varying degrees of avitaminosis, dehydration, and toxicity. It is difficult to compare, from a standpoint of hospital days, a series of cases treated in a naval institution with a series of similar cases treated in a civilian institution. As the

Navy has limited means for follow-up treatment, especially the patients in the Veterans' Administration, a longer hospital period of convalescence is required. Therefore, the results of the above method will be compared only with the results of methods previously used in this hospital. By the above method of treatment there has been a reduction in number of hospital days by 50 percent. Previously it was quite common for one of these cases to remain in the hospital for several months. Now, with the exception of the cases of neuritis, it is rare for one to remain as long as a month. The average period of hospitalization for a case of delirium tremens is now 2 weeks compared to 1 month by the previous treatment. The alcoholic peripheral neuritis cases remained in the hospital for months under the old form of treatment, and then usually were sent out with a steppage gait as a result of a foot-drop. Now advanced cases of this nature leave the hospital from 6 to 8 weeks with a beginning return of the deep reflexes. There has been no case of Karsakow's psychosis developed in the hospital since the above treatment had been in force. However, several such cases have been admitted and successfully treated. Until recently it was a common occurrence to transfer a patient to a mental institution with an alcoholic mental disorder because of little or no response to treatment over a period of weeks. During the past 9 months it has been necessary to transfer only one case, an alcoholic psychosis, which failed to respond in 4 weeks. There have been no deaths in this series of cases. When one considers that the mortality rate of delirium tremens is usually given from 15 to 20 percent, this alone, will show the success of this method of treatment. It is also interesting to note that of the first 100 cases so treated only 2 returned for further treatment and this was due to continued alcoholic indulgence.

SULFATHIAZOLE PROPHYLAXIS OF GONORRHEA AND CHANCROID

By Commander Maurice Joses, Medical Corps, United States Navy

Discouraged by the large number of cases of venereal disease developing in the crew of the *U. S. S. Houston* since our arrival on the Asiatic Station, in spite of the usual vigorous campaign of instruction in the well-known methods of prophylaxis, it was decided to try a new method of attack.

An analysis of the cases naturally showed that venereal disease was being contracted in the main by that group of individuals that is always present on board a naval vessel who, for one reason or another, mainly alcohol, will not take any prophylactic measures at the time of exposure or at any reasonable time after exposure. This type of individual has always existed and will continue to exist.

Encouraged by the excellent clinical results we were obtaining in the treatment of gonorrhea with sulfathiazole, which we have used almost exclusively since November 1940, with practically no reactions or complications, it was decided to try this drug as a method of late prophylaxis in this group of men.

With close cooperation of the commanding and executive officers and the junior division officers, all men who had indulged in sexual intercourse were urged to report at the sick bay the next morning where their sex experiences of the previous night were frankly discussed. Men who had used a rubber protective or immediate chemical prophylaxis were advised to continue that practice if they continued to expose themselves while ashore and nothing more was done in the case of these men. The men in the other group who had used no prophylaxis whatever were given 3 grams of sulfathiazole at 0800, another 3 grams at 1200 and 1 gram at 1800. They were further advised to use the condom the next time they were exposed and given a little talk about venereal diseases in general.

To date, we have given 150 men this form of late prophylaxis, or it might more correctly be stated, this abortive treatment of venereal disease prior to the onset of clinical symptoms, and not a case of gonorrhea or chancroid has developed in this group although the incubation period is well over. There has been one case of syphilis as might well be expected. It is realized that this is a very small series of cases from which we might arrive at any conclusions in a matter of this kind, but it does appear significant when it is realized that the percentage of infection among the prostitutes in the Manila area is very high.

We plan to continue this campaign and endeavor to arrive at some conclusion in regard to the optimum dosage. There have been no reactions whatever or interference with work in the case of this group, but it is quite possible that a smaller dosage may be equally effective.

It might be argued that this method of late prophylaxis will tend to make the men more careless in their sexual relations, especially in regard to the use of the condom or immediate chemical prophylaxis. Such has not been our experience on board this vessel. If anything, it would appear that the men are becoming more venereal-disease minded and are being more careful in their sexual relations ashore. At any rate, the incidence of venereal disease on board this vessel is dropping rapidly and, after all, that is our object.

Supplementary Report: Since our original report on the Sulfathiazole Prophylaxis of Gonorrhea and Chancroid was submitted, we have had an opportunity to use this form of prophylaxis in an additional 200 men who had used no other form of prophylaxis whatever after exposure, and there has not been a single case of gonorrhea or chancroid developing in this series of 350 cases. We have reduced the dose of sulfathiazole to 3 grams at 0800, 2 grams at 1200, and 1 gram at 1800, and plan to further reduce this dose until we arrive at some conclusion in regard to the minimum effective amount of this drug that is required.

Except for economy, however, there does not seem to be any particular reason to further reduce the present dose as no reactions or interference with work has occurred.

The medical officer of the *U. S. S. Marblehead* has also been using this form of prophylaxis and he informs me that he has given sulfathiazole to about 450 men who had been exposed to venereal disease in this same highly infected area. In this series of cases a few of the men had also used some other form of prophylaxis, however. In his group there have been no cases of chancroid and only one case of gonorrhea and this case proved to be refractory to treatment with any of the sulfonamide derivatives.

THE POSSIBLE DANGERS OF TRANSMISSION OF DISEASE BY AIRPLANE

By Commander Waddie P. Jackson, Medical Corps, United States Naval Reserve

With the great development of aviation in the last decade and all its advantages there are added two great disadvantages, that is its use as a deadly implement of warfare and the danger of conveying infectious diseases. The latter disadvantage is the subject of this discussion.

The diseases chiefly concerned are: cholera, plague, smallpox, typhus fever, and yellow fever, but also malaria and dengue may well be considered. The incubation periods of these diseases are from 2 days to 2 weeks. For cholera it is 2 to 5 days; for plague 2 to 6 days; for yellow fever 3 to 6 days; for typhus fever 5 to 12 days, and for smallpox 10 to 14 days. The usual flight traveling time is less than a week so that a traveler can very easily become infected just before departure and break out with the disease a day or so after reaching the port of destination. Thus the human being may be an important carrier during the incubation period of serious epidemic disease.

To prove airplanes do transport mosquitoes and are thus a potential danger, 4 reports are recorded. F. G. S. Whitfield (1) of London reported in 1939 that after examining 2,000 aircraft at Khartoum airport, 1,950 insects of 146 species were collected. Inclusion of the house fly would make a total of nearly 3,000. Of these 2,000 planes examined, 192 harbored infectious insects, excluding the house fly. These insects were fairly evenly distributed during the year, with slight increase from July to October. Among those insects were 4 species of *Anopheles*, 6 *Aëdes* including 2 of *Aëdes aegypti* taken at Molakai and 4 of *Culex*. Of 52 planes arriving at Kisumu from the north about 50 percent harbored insects including the *Culex* and *Anopheles* mosquitoes.

Griffitts and Griffitts (2) reported that after their inspection of 3 types of airplanes operated in the Carribean, namely the Fokker, Sikorsky, and Commodore, during July 23 to September 18, 1931, and from the 102 planes carefully inspected at Miami, 29 mosquitoes, 1 *Aëdes aegypti* and 28 *Culex* were captured. Twenty-four were caught on the Sikorsky, mostly in the front baggage compartment;

4 on the Commodore and 1 on the Fokker. This difference may be due to the difference in prevalence of mosquitoes at ports of departure.

They continued their experiment by obtaining the *Aëdes aegypti* and turning them loose in the planes on 3 different flights from San Juan, Puerto Rico to Miami, and were able to recover 22 of 100 let loose after traveling 1,200 miles in 10 hours and 10 minutes with 3 intermediary stops. They state that while certain tyes of airplanes carry mosquitoes, yet under average natural mosquito breeding conditions around airports, heavy infestation of aircraft would not be expected and only small numbers of mosquitoes would make the trip. However, even one infected *Aëdes* might start an epidemic. They also state that while airplanes may and do transport mosquitoes, this mode of introduction of mosquito-borne disease is probably secondary in importance to importation of infected man.

The prevalence of insects in the cabins of aircraft varies with the site of the airdrome, that is whether it is on land or water and the distance it is from the shore. There are many places in the planes where mosquitoes may rest and not be disturbed by air drafts, such as under seats, baggage compartments, etc.

Recent investigations by the Pan American Airways reported by Cummings in 1938 indicated that interior disinfection of aircraft is insufficient because the mosquitoes and other insects may find safe harborage in the space between the outer and inner linings of the aircraft, or in the hollow wings. The exterior of aircraft offers many hiding places such as the space for retracted undercarriage and various grooves and rivet holes.

E. V. Welch (3) reported that after the inspection of all incoming aircraft at Miami from Central America, South America, and Mexico in 1938, of the 398 aircraft examined 187 contained dead and live insects of various species. One hundred and sixty-six of the 651 insects recovered were alive in spite of the fact that the planes were sprayed carefully with an insecticide one-half hour before landing, as required by regulations. Of the 651 insects found, 45 were mosquitoes, 40 dead and 5 alive. No *Aëdes aegypti* were found but Griffitts has reported the *Aëdes aegypti* captured and identified from planes coming from Cuba and other Southern ports.

The transmission of insects by plane has thus been proven, and the short flying time indicates the ease with which an infected person may enter a port and in a few days come down with a serious insect-borne disease, thus being a potential danger of its spread.

Fortunately up to the present time there is not much indication that there has been a very serious increase in spread of disease by airplanes. However, Findlay (4) in 1938 strongly suggested this

possibility in noting the recent spread of yellow fever from the endemic zones in West Africa, as far eastward as the Southern Sudan. In 1933, 1 percent of the population had a positive yellow fever response to the mouse protection test, and in 1938, 21 percent gave the same positive response.

Dr. H. L. Schlotthauer (5) reported four unusual cases following, in a period of a few weeks, the arrival at Muroc of a group of military planes reported to have come from South America by way of Panama. There were cases of acute illness produced by the bite of an insect previously unknown to residents of the Mojave Desert. The symptoms varied from urticarial wheals and fever as high as 103 degrees, occurring an hour after the bite. There was also swelling of the affected area, lasting as long as a week. In one case there was lethargy of 2 weeks duration. All recovered after symptomatic treatment.

Specimens of these insects were taken, and identified as *Paratriatoma hirsutus*, Barber, considered a member of the family of blood sucking vectors of American *tripanosomiasis*. These are commonly seen in South America.

Yellow fever should be given some special consideration because of its tremendous importance and the possibilities of its transmission and cause of devastating epidemics. For a long time, *Aëdes aegypti* alone was thought to be the sole vector of yellow fever, and by 1914 it appeared that the disease might be eliminated. The Rockefeller Board undertook to do this and sent General Gorgas to Africa. Since that time, however, 32 species of mosquitoes, certain flies, bed-bugs, ticks, and cockroaches have been incriminated as yellow fever vectors. In the last 15 years several epoch-making discoveries have followed one another in rapid succession concerning this disease. In 1927, Stokes, Bauer, and Hudson (6) discovered that certain species of monkeys are naturally susceptible to the disease. Later, other animals were found susceptible and especially the English hedgehog. Certain species of mice may be rendered readily susceptible to yellow fever. B. J. Lloyd (7) says:

A method of preserving the virus in vitro indefinitely; the first method of attenuating the virus by passage through mice, rendering it not innocuous, but relatively so, for men and monkeys, but fatal to mice; development of a technique for immunizing against yellow fever by using attenuated (mouse brain) virus with immune serum; development of the mouse-protection test, which reveals the protective power of the blood of an immune person who may have had the disease half a century or more ago; proof by cross-immunity tests of the identity of Central American, South American, and African yellow fever by animal protection tests, and of Brazilian and African yellow fever by establishing cross-immunity, using separate strains of living virus; the discovery of a dozen or more new vectors of the disease (mosquitoes); the discovery of "jungle" yellow fever; the finding of immune individual monkeys in susceptible

races of monkeys in the forests of South America; the finding of circulating
yellow fever virus in the blood of monkeys in Brazilian forests; the discovery
that yellow fever is transmitted to man in the absence of all known vectors
(not in the absence of all mosquitoes) ; the development of a technique of
bed-side laboratory diagnosis by inoculation of mice with blood from the
patient; the use of the viscerotome in the post mortem histo-pathologic presump-
tive diagnosis of yellow fever; and the attentuation of yellow fever virus by
growing it in living tissue, and the use of this attenuated strain without
immune serum in immunizing human beings against the disease.

By a process of drying and freezing in vacuo, the virus of yellow fever may
be preserved in glass tubes for years at ice box temperatures. By passage
through mice which have suffered slight brain trauma, a neurotropic form of
virus has been produced which is only rarely lethal for monkeys, and which has
been used successfully with immune sera for immunizing both in man and
animals. Before the development of this technique there had occurred 36 cases
of yellow fever with 6 deaths as the result of laboratory infections. No cases
or deaths have since been recorded in immunized laboratory workers.

Among these discoveries one of the most notable is the so-called
mouse "protection test" of Sawyer and Lloyd (8) developed in 1931
following the discovery by Theiler (9) in 1930 that white mice are
susceptible to intracerebral injections of virus. This led to the most
important epidemiological discovery concerning yellow fever. This
was made by Soper (10) who, making use of the above information,
found a vast previously unknown reservoir of infection in the interior
of South America which he defines as "yellow fever recurring in
rural, jungle, and fluvial zones in the absence of *Aëdes aegypti* and
the absence of all the present known mosquito vectors, with the
possible exception of *Haemagogue*."

Dengue fever is also transmitted mechanically by two types of
Aëdes including the *aegypti* and possibly two others, so that a dengue
"reservoir" may be found in uninhabited jungle areas.

Malaria, in spite of accumulated knowledge concerning it, is said
by Simmons (11) to still exceed all others in sapping the vitality and
impeding the social, industrial and political progress of the inhabi-
tants of many tropical countries. So while we think of the *Anoph-
eles quadrimaculatus* as the vector there are many other vectors of the
Anopheles group of malaria, at least eight and probably more with
their different modes and localities of habitation. So, for the
past 20 years there has been no decrease in malaria in the Canal Zone
although the antimosquito work still goes on as much as ever, indi-
cating the difficulty of control in these tropical areas and the ease
with which it may be spread by the airplane.

These recent discoveries have introduced the following new
problems:

1. Search for still unknown vectors and hosts of the jungle infection.
2. Methods of protection of individuals exposed in those regions.

3. Precautions against the spread of these diseases from the jungle areas to Aëdes infested centers. Such spread has been traced in a few outbreaks.

In addition it may be well to quote Kolmer (12), who states:

Once any of these diseases become epidemic in the United States it is possible and probable that our own various insects may become conveyors or vectors of the organisms from animal to man or from man to animal.

Bennett (13) has already shown that the common Jersey mosquito can transmit yellow fever virus to monkeys. Kolmer also listed a great variety of insects that carry diseases all of which might be transferred by airplanes, but it is beyond this paper to enumerate them here.

Draper (14) in 1939 called attention to the vast number of aliens arriving from various countries and mixing with the others at Croydon, the London terminal. The inadequately manned and consequently poorly contrulled examination of the aliens leaves London "wide open," he says, for admission of these infectious diseases. At that time he said that only 20 percent of the aliens were being examined.

Up to March 1939, the International Sanitary Convention for Aerial Navigation did not apply to service aircraft of any nation, so unless they do conform to these regulations, preventable diseases may be spread by air, especially by aircraft moving from one command to another, in tropical and subtropical countries.

This danger was foreseen and resulted in the origin of the International Sanitary Convention for Aerial Navigation at the Hague in April 1933 (15), and has since been ratified by practically all the countries of the world. Each government has its own regulations regarding sanitary control of aviation, applicable at all official airdromes, for arrival and departure of foreign aircraft not permitted to land elsewhere. In case of a forced landing, the commander of the plane must notify the local authorities, and the crew, passengers, and cargo must not leave the vicinity until permission from the local authorities is granted.

The fear of the introduction of yellow fever into India is so great that that government prohibits people coming from suspected yellow fever areas of Africa to enter India until 9 days have elapsed since their departure from the affected area. India has even prohibited importation of yellow fever virus for research purposes. India, Egypt, and Iraq have virtually agreed to inform each other by telegram of any air passengers coming from a dangerous area.

The Health Organization of the League of Nations provides an international intelligence service which promptly informs health authorities throughout the world of the incidence of infectious diseases at various ports and airports.

Whitfield, because of the existence of yellow fever virus in the area involved has advised against an airplane route from London, via Africa, to India and Australia.

As a point of consolation to the British, Massey (16) has pointed out to them that the possible spread of yellow fever to the British Isles is not likely to be a serious matter because of the climate. The *Aëdes aegypti* cannot establish itself permanently and breed further north than 40 degrees latitude, which is about the equal to southern part of Spain. Against this assurance there is the possibility that some other vector might become infectious and be able to live and breed in that climate.

In the general procedure to prevent spread of infection, the countries concerned have adopted at least three precautions:

1. Systematic destruction of mosquitoes on all airplanes.
2. Vaccination of all flying personnel as soon as practicable.
3. Careful inspections of passengers to eliminate infected.

The Pan American Airways System has adopted the Pan American Sanitary Code, which in addition to this, agrees to present certificates showing the origin of the passenger's trip from the start to the end of the voyage and listing the localities visited 6 days prior to travel. The certificate of origin of passengers is not required if the passenger originates south of 30 degrees South latitude, unless he stops over for more than 1 day north of this area.

FIRST

For effectual destruction of mosquitoes in aircraft, a suitable sprayer and insecticide are essential. As previously pointed out, this method is not yet perfect but probably will be improved on from time to time. A suitable insecticide for aircraft has certain requirements. It must be:

1. Highly toxic to insects; 2, innocuous to passengers; 3, noninflammable; 4, noncorrosive and nonstaining; 5, stable in all climates and readily miscible with water. For this a water-soluble pyrethrum concentrate requiring dilution 10–14 times with water immediately before use is commonly used. About 30 cc. of 1:15 solution per 1,000 cubic feet of space is used. It is sprayed by a nebulizer. The plane is sprayed in the air about one-half hour before landing and the plane's ventilators are closed about 10 minutes after the spraying. Further, the airplanes may be fumigated during the night and opened the morning prior to embarkation of passengers.

SECOND

In addition to vaccination of the personnel as required, it is a very wise precaution for all passengers intending to travel by air through yellow fever areas to also receive the inoculation. One inoculation of the virus, which is issued in solidified form in ampules, is given in the

deltoid region about 14 days before expected date of arrival in the yellow fever zone. The contents of the ampule are dissolved in 1 cc. of cold sterile water and injected. Heat and alcohol will easily kill the virus. This protective inoculation has proven a most valuable preventive measure against yellow fever. Protection begins about a week after inoculation and is full developed in 90 percent of the cases in 3 weeks. The immunity lasts about 2 years and is equally effective against urban and jungle types of the disease. Since the personnel of the International Health Division was vaccinated, no case of yellow fever has occurred among them.

THIRD

The third precaution is the most difficult and is as follows:

1. Medical inspection of passengers.
2. Isolation in hospital of infectious cases other than tubercular or venereal.
3. Surveillance of contacts during the incubation period of the disease.
4. Proper disposal of excreta on arrival.
5. Provision for a safe drinking-water supply protected against mosquito breeding; the aircraft must be disinfected and emptied out and the tanks further disinfected before refilling with drinking water.

In addition, certain special measures are adopted regarding special diseases such as plague, cholera, typhus fever, and smallpox. If any one of these is found or suspected the following additional measures may be necessary:

1. Thorough cleansing of the aircraft.
2. Medical inspection of the passengers and crews.
3. Exclusion of any person showing symptoms of these diseases.
4. Inspection of personal effects if necessary.

In case of plague the following additional measures are used:

1. Immediate disembarkation of the sick.
2. Surveillance of contacts and suspects for not over 6 days.
3. Disinfection and disinsectization of personal effects.
4. Deratization.

For cholera the same measures are used as for plague except that the period of surveillance is 5 days and the drinking water must be disinfected and emptied. In addition, the unloading of fresh fish, shellfish, fruit, and vegetables is prohibited. This is true also if the airplane has come from a cholera-infested area. For typhus fever the measures are the same except for delousing and surveillance of 12 days. For smallpox, vaccination and surveillance for not more than 14 days.

In yellow-fever regions, the airdrome must be at an adequate distance from the nearest inhabited center, must be provided with a water supply protected against mosquitoes and mosquito-proof dwellings for

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aircraft crews and for the accommodation of passengers. Passengers and crews must be kept under surveillance for 6 days.

In case an airplane arrives from abroad, and a death occurs on board, the commander of the craft must notify the proper authorities. Infected aircraft, or those from infected areas, must not discharge passengers, crew, or cargo till the medical officer has examined them and declared them free from infection.

SUMMARY AND CONCLUSIONS

1. It has been proven that the airplane can and does carry live insects including some vectors of dangerous diseases.

2. The plane may very easily carry infected individuals if they are not discovered.

3. Fortunately, no serious epidemics have yet actually been traced to airplanes as the means of spread, but there is accumulating evidence that the airplane has played some part already in spread of disease.

4. There is still much more information to be obtained regarding other possible vectors of serious diseases and the possibility of this transmission by airplane.

5. With continued increase of flying speed and opening up of new routes of travel these dangers increase.

6. Many of these routes are either in or across the tropics and subtropics where most of these diseases abound.

7. There is little assurance that our tropical or subtropical communities are under sufficient control to prevent widespread transmission of a disease like yellow fever once it enters that community.

8. This danger is even more apparent today, since there are now known to be vectors of yellow and malaria fever other than the *Aëdes egypti* and *Anopheles quadrimaculatus*.

In view of these established facts it is incumbent on the proper authorities to see that all possible means known to prevent the introduction of those diseases should be used including especially:

1. A more widespread vaccination against yellow fever among those who travel in yellow-fever regions when the products become available for common use.

2. More liberal vaccination against cholera in cholera-infested areas.

3. More perfection in disinfecting airplanes.

4. More careful and thorough inspection of passengers and cargoes from planes coming from any of the infected areas. This last point is especially to be emphasized, because, as air travel becomes more and more popular and more and more within economical reach of the lower strata of society where these diseases are more prevalent, the dangers will become still greater.

Careful regulations under direction of thorough and competent health officers with adequate equipment and personnel may be the summing up of directions for control of a condition that has tremendous potentialities for spreading diseases and death.

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ONE-SIZE COTTON THREAD TECHNIC

By Lieutenant Commander K. P. A. Taylor, Medical Corps, United States Naval Reserve

Meade and Ochsner (1) have ably extended the clinical and experimental investigation of Ginkovskiy (2) on the use of cotton thread. as a suture and ligature. They have significantly called attention to the extraordinary advantages of cotton—ease of sterilization, universal availability, low cost, the lowest coefficient of wound irritation, in-

creased tensile strength after boiling, and the greatest retention of strength in tissues. The corresponding disadvantages are only two: lower initial strength than that of catgut, linen, or silk; and the comparatively "slow" silk technic of Halsted which Ochsner and Meade prescribe for cotton.

Logue and Walsh (3) have recently reported the remarkably successful use of cotton thread in 172 general surgical and orthopedic operations at the United States Naval Hospital at Pearl Harbor. These writers adhered to the Halsted method and used thread of three sizes— 50, 30, and 20. In three of their suppurative appendicitis and two of the cholecystectomy cases, suture sinuses developed requiring excision of the scar, removal of granulation tissue, or extraction of a suture. Their report is notable for the large variety of operations in which cotton thread was used and in their freedom from infection and wound irritation. The writer (4) has analyzed his experience with cotton in industrial and civil surgery. It has been parallel to that of Logue and Walsh.

The tensile strength of spool cotton is originally two-thirds that of linen, three-quarters that of silk. Use of a proportionately larger cotton size is therefore indicated. It is my experience, however, that a single-size spool-cotton thread may be used in all except an extremely limited surgical field. The thread selected is No. 24 plain black spool cotton (English scale) not mercerized. If No. 24 is not available as the suture unit, No. 20 or No. 30 may be used. Any thread selected should withstand 3 pounds weight bearing. Doubling, trebling, or quadrupling this thread provides any necessary suture strength, greater than that of the combined units though smaller in volume than an equally strong single suture.

The Halsted technic, originally applied to silk alone, predicates an increase in operating time of 25 to 50 percent. Largely for this reason (rather than unwillingness to use a "foreign body" suture material), surgeons have only recently witnessed a renaissance of the silk technic. To my own satisfaction, I have reduced the time factor for cotton thread to that of catgut. For this purpose the exacting technic of Halsted (and Meade and Ochsner) has been significantly modified; (a) A single-size thread is used; (b) continuous suture is permitted in some gastrointestinal technic and in peritoneal closure; (c) the transfixion-ligature is used only when indispensable for hemostasis; (d) the number of suture is reduced by using figure-of-eight fascia and mattress retention sutures; (e) the fatty tissue layer of sutures may usually be eliminated if sutures are applied as in (d).

PREPARATION OF COTTON THREAD

As advised by Ochsner and Meade (1) sterilization is effected by boiling the thread for 20 minutes. Prior to boiling, the thread is

looped about a rod and a 3-pound weight attached. Support of the weight for one minute is considered an adequate test. The thread is then wound on two flat wood reels, 7 and 14 inches long (sutures); single and doubled thread is also wound on half-inch rubber tubing (ligatures). The reels and rubber spools are then boiled with their charges of cotton. To secure sutures, the operating nurse cuts across the thread on the reels, creating 14- and 28-inch strands. The former are for single, the latter for double sutures. Ligatures are tied directly from their rubber spools. Extra long, single, or double sutures are also cut from the thread rolled on tubing. Since there are no containers to open and no material to be softened or straightened, the preparation of ligatures and sutures for operation is extremely rapid and simple, a factor of great importance under battle conditions. Following a clean operation, the unused thread on rubber tubing may be placed, still wound, in alcohol. After the original boiling it may often be re-used up to six months or longer. Before reboiling such thread for another operation, its tensile strength should be checked.

<center>OPERATIVE TECHNIC</center>

The doubled 14-inch thread is used to ligate thick pedicles. It is also employed for suture-ligature of the broad ligament, uterine, and ovarian arteries; to ligate the entire meso-appendix; for continuous suture of the gallbladder bed; in the uterine wall after myomectomy, hysterotomy, or Caesarean section. For the external layer of gastro-enterostomy sutures, the doubled continuous thread is also used; for the inner layer, a single continuous suture. In gastrectomy the serosal stitch may be an interrupted double-thread mattress suture; for entero-anastomosis a continuous single thread is used for the inner (mucosal) suture; interrupted or continuous single suture for outer layer of small intestine; interrupted or continuous double suture for seromuscular layer of large intestine. The appendicial stump is ligated with the double thread, and religated at the same level. If used, the inverting stitch may be a single figure-of-eight. Interrupted single cotton sutures are used in anterior and posterior colporrhaphy; double sutures to approximate the levator ani muscle fibers, and for hemorrhoidectomy. A single or double suture is used for shortening the round ligaments; quadrupled cotton thread for ventral fixation. Bleeding points are ligated with the single strand, cut upon the knot.

An infected field should encourage the use of cotton sutures and ligatures. Since cotton is least permeable for cell growth, sinus formation and extrusion seldom occur. Nor is healing delayed in the presence of cotton. Single 24 cotton thread is applicable to suture of the larger nerves, arteries, and veins, and to all tendon surgery. It can confidently be used in facial injuries. In contrast to Meade and Ochsner's selections of 4 or 5 cotton sizes for routine operative pro-

cedures, the single size or unit technic has obvious advantages for the entire personnel of the operating room. For emergency surgery and battle conditions its usefulness and expediency are especially evident.

ABDOMINAL CLOSURE

The peritoneum is closed with a doubled continuous suture, everting the peritoneal edges if convenient. All hemostats are now removed from the wound, and reapplied only to points which continue to bleed. These are ligated. Figure-of-eight retention through and through sutures of quadruple cotton thread are prepared with needle and needle holder applied to each end. These sutures are passed through the fascial margins, then the ends withdrawn through opposing skin edges. These figure-of-eight sutures are very strong, soft, and pliable and do not tend to cut through tissues. They secure approximation of fascia and skin without pressure or strangulation.

They are placed 3 cm. (1¼ inches) apart, and are not tied until all of the fascia sutures have been set. Between each through and through stitch is placed a single interrupted fascia suture. This is passed twice through each fascia margin, forming fine figure-of-eights. Since each twice passed fascia suture is the tensile equivalent of two single sutures, the number of sutures and knots in the fascia is reduced by half. When through and through stitches are not used (in small incisions) the twice passed fascia sutures should be placed at 1 cm. intervals. Each fascia stitch is tied when set. A triple throw knot is an added precaution, probably not necessary for plain (not mercerized) cotton, provided a square knot is tied. As the sutures are tied the thread ends are dropped toward the lower angle of the wound; when all are tied, the ends are lifted together, and the threads cut close to or on the knots. A needle of each through and through suture is passed through a narrow rubber tubing, and the suture ends secured. Interrupted single skin sutures are introduced on straight needles—if the figure-of-eight skin and fascia retention sutures have been used, it is customary to use but one skin stitch between each mattress suture. As the skin stitches are tied their ends are also dropped toward the lower wound angle. When the line of stitches is completed, their ends are lifted together and cut with a single stroke.

With respect to strength this wound closure is more than adequate. It can be done as rapidly as a conventional catgut sew-up. There is a great saving in time and no disadvantage in using the 24 cotton thread as a simple ligature in the abdominal wound. To minimize the amount of foreign material left in the wound in this manner, however, it is most important to ligate only areas that bleed after hemostat compression. The transfixion ligature is seldom necessary except in special situations, such as the tonsil fossa, where it has been used

with entire satisfaction (most bronchoscopists agree that should so small a foreign body make its way into the tracheobronchial tree it could not produce a significant lesion).

RESULTS WITH COTTON THREAD

Beginning in December 1939, a consecutive series of 150 major (and a larger number of minor) operations were carried out with cotton exclusively. One severe (suppurative appendix) and two minor (stitch abscess) wound infections were observed. The dressings are usually undisturbed until suture removal on the 5th day in short, 12th day in long incisions. The four-strand through-and-through sutures serve effectively as capillary drains of the subfascial and subcutaneous areas. There has been a striking absence of serum accumulation in postoperative wounds, a fact which bears out the experience of all other observers. Sinus formation was seen in a single case in which bladder trauma probably occurred. No foreign body tumors or unusual keloid developments were observed; no sutures have been expelled; disruption or herniation have not been experienced. Patients have been agreeably impressed by the ease of removal of the soft cotton skin and mattress sutures.

RÉSUMÉ

1. Technic is presented for the use of a single size cotton thread.

2. Modifications of Halsted's technic enable the surgeon to approximate the speed of catgut surgery.

3. Limitations to the use of cotton in this manner have not yet been encountered.

4. The applicability of this method to emergency surgery and to war experience is outstanding.

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SENSITIVITY TO INSULIN

By Lieutenant, junior grade, J. H. Higgins, Medical Corps, United States Navy

Helmuth Ulrich (1), M. D., Chief of the Diabetic Service at Massachusetts Memorial Hospitals, Boston, states the following in

the New England Journal of Medicine, October 1939: "The relation of diabetes to allergic diseases in general is an interesting one. In our experience asthma or hay fever has rarely been observed together with diabetes in the same patient." In this same article Joslin also comments on the "rarity" with which asthma is encountered in diabetics and Kern mentions that they have a high reciprocal familial incidence, but seldom occur in the same patient at the same time.

Allergic reactions to insulin, while known to occur, are rarely noted in literature on diabetics. The occurrence of allergic manifestations after treatment with insulin throws some light on the nature of the hormone. It indicates that the protein of animal insulin is different from that of human insulin, furthermore, the hypersensitiveness, sometimes shown toward insulin from one species with tolerance toward that from another suggests that the pancreatic extracts contain another pancreatic protein besides insulin. The pig and beef pancreas have been the chief sources of supply for insulin, while the pancreas of sheep, fish, and birds have been used experimentally.

Local reactions usually manifest themselves between the third and fourteenth days after beginning treatment. It is very unusual for one to appear with the first injections. However, if a hypersensitive patient has had previous treatment which has been interrupted, he may show a reaction immediately upon resuming the medication. Where insulin has been used continuously for two weeks without trouble, it is rare for any allergic manifestation to appear.

The local reaction may be mild, consisting of an area of redness, a wheal or nodule, accompanied by burning and itching which will disappear in 1 to 3 days, or it may be more severe and one may note an intense inflammatory change at the site of injection with the formation of a hot, tender tumor causing unbearable burning pain. This lesion usually begins to appear within an hour after the injection, but may be delayed until the next day and may not completely disappear for several weeks.

General allergic reactions to insulin are manifest by cutaneous, circulatory, and gastro-intestinal symptoms. Urticarial eruptions and edema, preceded by numbness, tingling, and itching of the affected parts, are the more common cutaneous changes. There may also be swelling of the mucous membranes of the mouth and larynx causing respiratory embarrassment. Pallor, flushing, and palpitation appear at the beginning and may be quickly followed by circulatory collapse with a weak pulse, low blood pressure, and prostration. Abdominal cramps, nausea, and vomiting also may occur, but are not common. These severe symptoms usually subside within an hour, but the patient may be prostrate for several days. Usually there is a local reaction before the appearing of general symptoms,

and the general reaction described does not occur with the initial treatment. It appears rather in those who have been receiving insulin for several days or in those who have started using the hormone again after a period of cessation. According to Allan (2), local reaction at the site of injection may depend upon chemical irritation as well as on allergy. This was more common with earlier cruder preparations of the drug. However, insulin must be kept in a slightly acid solution, since it is unstable in neutral or alkaline states. Some patients are relieved of itching if the insulin is neutralized just before injecting. Another condition which must be distinguished from insulin allergy is irritation from denatured alcohol used for sterilization of the skin; this is sometimes caused by the formalin in the alcohol. Yet another cause of local reaction is improper technique in injecting the insulin.

"Gastro-intestinal allergic reactions are sometimes confused with the common organic lesions of the abdominal tract, such as appendicitis or cholecystitis," as in the case described by John R. Williams, M. D., of Rochester (3). This patient, aged 52, gave a history of diabetes extending over a period of 6 years, during which time she had taken insulin constantly. In September of 1931 she began to have distressing gastro-intestinal disturbances, which disappeared altogether when beef was substituted for pork insulin. Subsequent tests proved that she was sensitive not to insulin, but to something in insulin from the pork pancreas—probably another pancreatic protein.

It is generally recognized that reactions from insulin are more severe with protamine zinc insulin than with the older type; however, the purest preparations of commercial insulin all contain a small amount of protein. Even crystalline insulin is at least a polypeptide.

Allan (2) tells us that skin tests may be employed in the investigation of insulin allergy; the chief value of intracutaneous tests being not for the recognition of insulin sensitivity but to guide attempts at treatment. Tests made with various preparations will show variable degrees of reaction and can be selected for therapeutic use accordingly.

In some of these less severe local reactions the patients will desensitize themselves in a short time, in others changing the brand of insulin will affect a cure. Another method of desensitization in generalized reactions, where other attempts including desensitization with dilute gradually increasing doses of insulin have failed, is to give the individual active serum from a rabbit which has been sensitized to this patient's serum. The newest, and as yet, a still unproven type of treatment, is with histaminase.

Histamine, considered a noxious substance in large amounts and believed by many to be the prime factor in allergic reactions, is detoxified by histaminase, an enzyme, which is found in various body tissues and body fluids, including lung, liver, kidney, blood, muscle, spleen,

adrenal gland, duodenum, jejunum, and cecum.   The greatest activity
is found in tissue from the kidney and small intestine.   Histaminase
is now prepared, as a stable dry powder, from beef kidney.   From
studies made in vitro, it is apparent that the reaction of histamine
to histaminase is an oxidative one, and that the enzyme causes a rup-
ture of the iminazole ring.

From present experiments the success in treating allergies with this
new drug depends upon proper and adequate dosage recommended at
from 30 to 75 units a day, depending upon the severity of the case and
the patient's reaction.   As yet it is too new to say definitely what it
will do.

The following is a case history of a patient sensitive to regular,
protamine zinc and crystalline insulin.

This patient, age 69, came to the hospital December 28 with a history of falling
from a stepladder the previous day.   He complained of pain in the right chest,
over the lower ribs posteriorly, and over the sternum anteriorly; there was mod-
erate swelling of the right wrist.   X-ray failed to reveal any fracture.   Because
of a past history of diabetes, since 1922, a blood sugar was taken showing 400
mgs.; the patient was transferred to the medical ward for care of his diabetic
condition.   His weight was 171 pounds.

His past history revealed that he first took insulin in 1922, using 10 units of
regular insulin daily for 1 month.   He next used it in 1936, taking 25 units daily
for 4 months.   There were no reactions from any of these treatment, and he
has taken no further insulin up to his present hospitalization.

On December 30 his urine showed 1.43 percent sugar and the blood sugar was
375 mgs.   On December 31 he was started on 20 units of regular insulin daily and
placed on a low carbohydrate diet.

January 3 the urine still showed 2 percent sugar, and the blood sugar was 230
mgs.; the insulin was increased to 30 units daily, giving 5 units of regular and 5
of protamine zinc in the morning and 10 units of regular at noon and at night.

On January 6 his calorie intake was cut to 1,992.

About 4 hours after the patient had received his evening medication on January
8, he suddenly developed a diffuse urticaria; this cleared up on administration of
adrenalin.   It was now 9 days after the insulin was administered and 5 days
after the use of protamine zinc.   However, for 2 days preceding, he complained
of itching.

Protamine zinc insulin was discontinued the following day, and regular insulin
given.   Within 10 minutes after his initial dose an extensive urticaria ensued,
with large blebs behind the ears.   To allay the condition adrenalin was again
used.

The patient apparently being allergic to both kinds of insulin, was given none
on the following day.   On January 11 crystalline zinc insulin was given for the
first time.   Fifteen units were administered, and within 5 minutes the patient
had developed an urticaria and an angioneurotic edema, which covered the entire
body.   Ten minutes later the patient was in an anaphylactic shock.   His pulse
became rapid, then almost imperceptible, and his entire body glowed with an
intense erythematous rash.   He rolled about in pain, complaining of blurring
of vision, and a burning sensation over his entire body.   Adrenalin gave imme-

diate temporary relief, but an hour and a half later it had to be repeated with morphine, and as symptoms reoccurred repeated again in 2 hours. At 9 p. m. that night, 5 hours after the insulin was given, the patient was given nembutal and spent a restful night.

It is interesting to note that these reactions had been of increasing severity and that the one following the use of plain insulin was more easily controlled than the others.

On January 11, the blood sugar was still 300 mgs., however, insulin was discontinued the following day and his caloric intake cut to 1,295, with 105 gms. carbohydrate, 65 gms. fat, and 70 gms. of protein.

Beginning January 13, desensitization was started, using regular insulin, 40 units to the cc. in the process.

Dilution 1–10,000 (January 13, 1940)

	cc.
8 a. m.	.1
10 a. m.	.2
12 a. m.	.4
2 p. m.	.8
4 p. m.	1.6
6 p. m.	3.2
8 p. m.	6.4

Dilution 1–1,000

10 p. m.	.65
12 p. m.	1.3
2 a. m. (Jan. 14, 1940)	2.6
4 a. m.	5.2

Dilution 1–100

6 a. m.	.1
8 a. m.	.2
10 a. m.	.4

Dilution 1–10

12 noon	.8
2 p. m.	1.6
4 p. m.	3.2

By this time he had received a total of 25 units of insulin on January 14 without any allergic reaction. The next day his caloric intake was raised to 1,690, with 140 gms. of carbohydrate, 90 gms. of fat, and 80 gms. of protein. Twenty units of insulin were now given with no reaction.

On the following morning, January 16, 10 units of insulin were given. The patient complained of his lips feeling swollen but there were no physical findings. He received 10 units at noon, and again at 4:15 p. m. By 6 p. m. he had developed an urticaria, and again required adrenalin. On the next day, 30 units were given; he complained of a little itching but the reaction was slight, requiring no treatment.

Since this time the patient has received 30 units of insulin daily and is still on 1,690 calories. Blood sugar level ranges from 150 to 158 mgs. He has lost 8 pounds since admission to the hospital.

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PRIMARY SITE OF CARCINOMA OF LIVER, LUNGS, AND BONE

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Carcinoma is often found in the liver, lungs, and bones, but is usually secondary, with the primary lesion elsewhere.

In order to determine roughly, by the laws of probability, the site of the original tumor, it is necessary to know the incidence (table A, Cook County, 1937), and the percentage of metastasis of cancer of the various organs to the liver, lungs, and bones (list B).

From these data, list C is computed and submitted.

TABLE A.—*Primary incidence of fatal cancer (Cook-County, 1937)*

	Percent of total			Percent of total	
	Male	Female		Male	Female
	Percent	*Percent*		*Percent*	*Percent*
Oral and pharyngeal	6.4	2.4	Uterus		20.5
Lips	.6	.9	Prostate	8.4	
Mouth	2.4	.6	Other genito-urinary	9.4	9.2
Tongue	3.2	.8	Kidney and ureters	2.0	1.4
Tonsil and pharynx	4.9	.4	Bladder	5.0	1.8
Stomach and duodenum	22.7	13.4	Vulva and vagina		2.0
Intestine	9.9	12.3	Testis	1.3	
Illeum and jejunum	.8	1.0	Penis	1.0	
Colon and appendix	9.1	11.3	Breast	0.3	17.7
Rectum and anus	7.4	4.4			
Other digestive organs	14.7	12.2	Total genito-urinary	18.1	47.4
Liver	2.0	2.0			
Gall bladder	2.0	6.0	Skin	1.2	.9
Pancreas	2.0	2.0	All other	7.4	4.0
Esophagus	8.0	2.0	RÉSUMÉ		
				Male	*Female*
Total digestive	61.1	44.7	Digestive	61.1	44.7
			Respiratory	12.2	3.0
Lungs and pleura	7.3	2.6	Genito-urinary	18.1	47.4
Larynx and other	4.9	.4	All others	8.6	4.9
Total respiratory	12.2	3.0	Total	100.0	100.0

List B-1.—*Secondary cancer to lungs*

Of all **malignancies 30 percent** metastasize to lungs.

Of oral and pharyngeal cancers 30 percent metastasize to lungs.

Of gastric cancers 20 percent metastasize to lungs.

Of intestinal cancers 15 percent metastasize to lungs.

Of liver cancers 20 percent metastasize to lungs.

Of pancreatic cancers 20 percent metastasize to lungs.

Of breast cancers 45 percent metastasize to lungs.

Of uterine cancers 15 percent metastasize to lungs.

Of ovarian cancers 10 percent metastasize to lungs.

Of prostatic cancers 35 percent metastasize to lungs.

Of thyroid cancers 65 percent metastasize to lungs.

Of kidney cancers 75 percent metastasize to lungs.

List B-2.—*Secondary cancer to liver*

Of all cancers 36 percent metastasize to liver.

Of all portal cancers 50 percent metastasize to liver.

Of nonportal cancers 32 percent metastasize to liver.
Of breast cancers 48 percent metastasize to liver.
Of stomach cancers 44 percent metastasize to liver.

List B-3.—Secondary cancer to bones

Of all malignancies 22 percent metastasize to bones.
Of prostatic cancers 93 percent metastasize to bones.
Of breast cancers 45 percent metastasize to bones.
Of thyroid cancers 28 percent metastasize to bones.
Of kidney cancers 35 percent metastasize to bones.
Of head and neck cancers 6 percent metastasize to bones.
Of gastric cancers 3 percent metastasize to bones.
Of rectal cancers 7 percent metastasize to bones.
Of uterine cancers 4 percent metastasize to bones.

If lists B, taken from Nelson's Loose Leaf Surgery, as given above is correct, then list C is roughly correct.

List C.—Given cancer of liver

Men

26 percent metastatic from stomach.
20 percent metastatic from intestine.
14 percent metastatic from other digestive organs.
14 percent metastatic from genito-urinary tract.
9 percent metastatic from mouth and pharynx.
5 percent metastatic from lungs.
6 percent metastatic from miscellaneous.
6 percent metastatic primary.
NOTE.—36 percent of all cancers metastasize to lungs.

Women

20 percent metastatic from breast.
18 percent metastatic from intestine.
16 percent metastatic from uterus.
13 percent metastatic from digestive organs.
12 percent metastatic from stomach.
7 percent metastatic from other genito-urinary (ovary, vulva, kidney, and bladder).
1 percent metastatic from lungs.
1 percent metastatic from mouth.
6 percent metastatic from miscellaneous.
6 percent metastatic primary.

Given cancer of lungs

Men

27 percent metastatic from genito-urinary tract (9 percent prostate).
19 percent metastatic primary.
17 percent metastatic from stomach.
11 percent metastatic from oral and pharyngeal.
9 percent metastatic from other digestive organs (esophagus, liver, pancreas, gall bladder).
8 percent metastatic from intestine.
9 percent metastatic from miscellaneous.
NOTE.—30 percent of all malignancies metastasize to lungs.

Women

32 percent metastatic from breast.
12 percent metastatic from uterus.
10 percent metastatic from stomach.
10 percent metastatic from intestine.
10 percent metastatic from other digestive organs.
6 percent metastatic from primary.
6 percent metastatic from other genito-urinary (vulva, ovary, bladder, and kidney).
5 percent metastatic from thyroid.
3 percent metastatic from oral and pharyngeal.
6 percent from miscellaneous.

Given cancer of bones

Men	Women
45 percent metastatic from prostate.	43 percent metastatic from breast.
18 percent metastatic from lungs.	14 percent metastatic from miscellaneous.
13 percent metastatic from miscellaneous.	12 percent metastatic from thyroid and adrenals.
7 percent metastatic from stomach.	8 percent metastatic from intestine.
7 percent metastatic from intestine.	7 percent metastatic from lungs.
4 percent metastatic from kidney.	6 percent metastatic from uterus.
2 percent metastatic from other digestive organs.	5 percent metastatic from stomach.
3 percent metastatic from head.	3 percent metastatic from kidney.
1 percent metastatic from thyroid and adrenals.	1 percent metastatic from head.
	1 percent metastatic from other digestive organs.

The subdivision of other digestive organs" in table A, not shown in source material, is as follows:

Liver, under 2 percent (Ewing).
Gall bladder, 6 percent of all, predominant in females (Ewing).
Pancreas, 2 percent, equally by sexes (Ewing).
Esophagus, 3 percent, predominant in males (Stout).
Roughly transposed to the Cook County figures this would give:

Incidence of "other digestive" cancers

	Men	Women
	Percent	*Percent*
Cook County, total	14	12
Liver (maximum)	2	2
Pancreas	2	2
Gall bladder	2	6
Esophagus	8	2

The figures in list C for primary cancers of liver and lungs are maximum figures and are arrived at by the following data:

Thirty percent of all cancers metastasize to lungs and pleura.

Seven percent of all cancers (male), primary in lungs and pleura (Cook County).

Therefore, 7:37 as x:100, or x equals 19, equals maximum percentage of primary tumors.

Thirty percent of all cancers metastasize to lungs.

Two percent of all cancers (female) primary in lungs and pleura (Cook County).

Therefore 2:32 as x:100. So x equals 6, equals maximum percentage of primary cancers.

Thirty-six percent of all cancers metastasize to liver.

Not over 2 percent of all cancers are primary liver carcinomata. Therefore 2:38 equals x:100. So x equals 6, equals maximum percentage of primary liver carcinomata.

Summary.—Tables are given, whereby, in cases of cancer of the liver, lungs, or bones, the location of the primary tumor may be estimated by the laws of probability.

THE TREATMENT OF INTRACTABLE PRURITIS ANI BY TATTOOING WITH MERCURIC SULFIDE (CINNABAR)

By Lieutenant, junior grade, Leon Taubenhaus, Medical Corps, United States Naval Reserve

The treatment of pruritis ani may, at times, present many difficulties and only too often the results are unsatisfactory. This is easily understood when one considers the statement of Gant that there are over 200 causative factors for this condition and that the methods of treatment are over double this number.

In view of the poor results obtained by any one method of treating this condition, one is reluctant to offer any new methods of therapy. However, the good results reported on the use of mercuric sulfide tattoo, warrants further consideration of this method as it promises to be definite value in selected cases.

In considering the etiology of pruritis ani, Simmons (1) conveniently classifies the causative factors into four groups. Group 1 consists of local pathological changes in or about the rectum and anus. In this group are included ulcers, hemorrhoids, fissures, fistulae, and carcinomata. The second group includes infections of the skin or mucous membranes and may be due to bacteria, pediculi, or mycotic organisms. In this group, I should like to point out the importance of epidermophytosis. In the third group are included systemic diseases. Here may be mentioned diabetes, hepatic disease, anemia, goiter, menopause, pregnancy, intestinal parasites, genito-urinary conditions, syphilis, neurosis, and allergy. The role of allergy is often more prominent than suspected and the allergic factor is often difficult to rule out. The fourth group includes the idiopathic or essential pruritis ani. These are the cases in which all causes, local and general, have been ruled out and which present the difficult problems in the treatment of this disease. It is this type of case that prompted the writing of this paper.

In the treatment of pruritis ani, all causative factors must be meticulously sought after and eliminated. Palliative measures may be used in conjunction. There are, however, a certain number of cases which will not be controlled by the above-mentioned therapy. These are the cases that are usually the most severe and which often come

to some form of destructive surgery such as neurectomy or resection of the perianal skin before they can obtain permanent relief. It is in these cases that tattooing deserves a trial as it may often spare the patient an operation.

The idea of tattooing with mercury sulfide is not new and is based on empirical observations. In 1928 Belote (2) noted from cases of his own and from the literature that syphilitic papules have never been observed to appear in the cinnabar portion of the tattoo, although they are seen in the black or other portions of tattooes. He thought this due to the protective influence of the mercuric ion.

Hollander (3), in 1938, reported the successful treatment of 15 cases of pruritis ani by tattooing with mercuric sulfide. Since them numerous other reports have been published. Sulzberger (4) reported 3 cases. Turrell (5) and his associates reported 22 cases and recently Turrell (6) has reported on 37 cases.

TECHNIC

The technic has been adequately described in the literature (3), (5), (7). The apparatus consists of an electric tattooing machine capable of making 3,000 vibrations per minute with needle handles containing 6 to 20 needles in a single row and protruding 2 to 3 mm. Usually 8 to 15 volts are required to run the machine, depending on the tension of the spring. The machine may be sterilized by formaldehyde vapor. The professional tattooers, however, use little or no antisepsis and have remarkably few infections.

The mercuric sulfide is made into a thick paste with sterile distilled water.

The perianal region is shaved and prepared in the usual manner with green soap and alcohol. Following this, a thin layer of carbolated vasoline is applied over the area. This prevents staining of the skin by the cinnabar and more clearly outlines the tattooed area.

All types of anaesthesia have been used. While some men prefer to use spinal or caudal anaesthesia, others prefer local infiltration with 1 percent procaine hydrochloride. This latter method is preferable as it distends the skin and thus facilitates the procedure. It also has the advantage of allowing tattooing to be an office procedure which may be done in multiple stages and thus spares the patient the price of hospitalization and spares the doctor the task of a complete tattoo job in one sitting.

The tattoo machine should be grasped by the first three fingers in a similar manner to a fountain pen. The needles should be dipped in a cinnabar paste rather than applying paste to the skin. The operator may steady his hand against the vibrations of the machine by leaning his forearm against the patient and fanning his three fingers against the skin for additional support.

The skin to be tattooed must be held taut, and the needles must enter the skin at an angle of 45°. It is essential that the cinnabar pigment be deposited in the corium only and that the entire pruritic area be tattooed. If any skip areas are noticed, they must be retattooed. The machine is moved lightly over the skin in either a brushing back-and-forward or a rotary movement. This must be done slowly in order to prevent skip areas. The tattoo should extend well into the anal canal.

422500—42——10

While the results reported have been quite good, an occasional recurrence has been reported. This may be due to skip areas, which should be retattooed. Goldman (8) has pointed out that if the tatooing is carried too deep beneath the corium, the mercury will form a mercuric proteinate which is absorbable. Turell (6) has reported 3 recurrences in his 37 cases. However, none of them have been as severe as they were before being tatooed.

No serious reactions have ever been reported following tattooing with mercuric sufide for pruritis ani. In Turell's (6) series, three patients noted a transient, scaly dermatitis in the tattoo perianal region. Eight patients developed paraesthesias in the tattooed area, the character of which was definitely unlike the original pruritis. These paraesthesias appeared in 2 weeks after the tattooing and completely disappeared in 4 to 6 weeks. He has also seen 2 cases of transient renal irritation with spontaneous recovery.

As long as mercuric sulfide is the only agent so far known to be effective in the tattoo treatment of pruritis ani, mercury reactions are a possibility which must be considered. All cases should receive a patch test for sensitivity to cinnabar before treatment. If a sensitivity is shown, treatment by tattoo is contraindicated. Ballin (9) reports a case of cutaneous hypersensitivity to mercury occurring years after a tattoo on the forearm. He also reports a case of Unna's in which a man was tattooed as a youth, and, many years later, while receiving mercury inunctions, developed a cutaneous reaction of the cinnabar portion of his tattoo. No such reactions have ever been reported so far in perianal tattoos, but they must be kept in mind as a possibility.

The rationale of tattooing with cinnabar as a treatment for pruritis ani is not clearly understood. Nevertheless, in those cases successfully treated, there has been a relief of the itching and the skin has returned to normal texture. Hollander believes that the good results are due to the antiseptic action of the cinnabar. To be effective, the mercuric sulfide must be in the corium. This suggests to Turell that the macrophages which are abundant in the normal corium may have their phagocytic activity increased by the mercury, thus producing a nonspecific local immunity. Recent studies (6) also indicate that a pharmacodynamic degenerative effect may be exerted by the mercuric sulfide on the cutaneous terminal nerve supply.

If, as suggested by Tucker and Helling (10), the pathology of pruritis ani is solely that of chemical dermatitis, the possibility exists that the change in the chemical equilibrium of the skin brought about by the mercuric sulfide may produce the good results.

CONCLUSIONS

1. In all cases of idiopathic pruritis ani, in which local and general causes have been carefully ruled out and palliative treatment has

been unsuccessful, tattooing of the pruritic area is suggested as a method of treatment.

2. Tattooing should always be considered before surgical methods, such as neurectomy, excision of the pruritic skin, and other surgical procedures not aimed at correcting local pathology.

3. All patients to be tattooed should previously be skin tested for sensitivity to cinnabar.

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SYPHILITIC EPIDIDYMITIS

By Lieutenant H. J. Cokely, Medical Corps, United States Navy

Since the advent of the modern treatment of syphilis, complicating lesions, so often seen in the pre-arsphenamine era, are becoming more and more infrequent. Even so, lesions do occur perhaps more often than we suspect. The appearance occasionally of some unusual complicating lesion, even in those cases treated according to the modern concept, would lead us to believe that there are still advances to be made in syphilitic therapy.

Although a rare condition, primary syphilitic involvement of the epididymis does occur. Probably Astruc (1), in 1936, as reported by Thompson (2), was the first to recognize syphilitic involvement of the scrotal contents. Most clinicians at that time considered any involvement of the epididymis as being secondary to a similar involvement of the testicle. This belief continued until 1863, when Dron (3),

reported 14 cases of primary syphilitic epididymitis. Balme (4), in 1876, saw 13 cases in 2,300 syphilitics. Keyes, in his *Test of Syphilis*, published in 1908, notes that he has seen but 1 case. Wright (5), in 1916, reported 2 cases. Lisser and Hinman (6), reporting a case in 1918, state that a careful search of the Index Medicus and the Index Catalogue of the Library of the Surgeon General revealed only 1 article dealing directly with this subject since 1908. Michelson (7) reported 7 cases in 1918; Rolnick (8) 4 cases in 1924; Greditzer (9) 1 case in 1927; and McLachlan (10) 7 cases in 1938. Modern textbooks mention this condition as a rare complication of an improperly or untreated infection, or as a tertiary lesion.

Primary syphilitic epididymitis may be present in one or three clinical forms—namely, acute diffuse, chronic diffuse interstitial, and gummatous. Involvement is very seldom seen before the second month of infection and is most common between the first and fifth years. Early infection is usually unilateral, although bilateral involvement occurs in about 10 percent of cases. Specific epididymal lesions appearing in the secondary stage of syphilis, along with skin and mucous membrane lesions, disappear spontaneously with institution of treatment. This type of case is seldom diagnosed.

In the acute diffuse form the onset may be gradual, usually after the second month and before the fifth year. Involvement of the epididymis alone is the general rule and is characterized by severe pain. The surface of the epididymis is smooth and of elastic consistency, exceedingly tender to pressure and easily distinguishable from the testicle proper. If progress is not checked with adequate therapy, the process may become chronic. The presence of an inflammatory hydrocele is not unusual.

The chronic form, if not a sequel of the acute type, is of slow and insidious development, and usually is without acute pain. The patient generally complains of a dull and dragging pain in the scrotum and along the inguinal canal. Palpation of the epididymis shows it to be hard and boardlike with an irregular surface. This has been called the "testiculé enbois" (wooden testicle) by Oudard (11). Associated hydrocele is not unusual, many times causing an error in diagnosis. Wright (5) reports a case where, in the course of a hydrocelectomy an enlarged, hard, and nodular epididymis was found. Castration was done on that side for what was thought to be an acid-fast infection. The lesion was later shown to be syphilitic, and that castration was done needlessly.

Gummatous epididymitis is usually, although not always, a late manifestation of syphilis. Like the chronic form, onset is slow and generally without pain. Many times it is associated with similar gummatous lesions of the testicles, and may be masked by a large

hydrocele. The epididymis is hard, painless, and nodular. Gumma may usually be palpated in the head or body of the epididymis and may be solitary or multiple. These lesions may be as large as an olive. In the untreated cases, rupture through the scrotum with formation of "fungus" testicle, is not uncommon.

The differential diagnosis may at times be very difficult. This is pointed out in the case presented in this paper. Gonorrheal epididymitis, tuberculosis, bacillary or nonvenereal epididymitis and tumor must be ruled out. The fact that in syphilis the process usually attacks the globus major, with extension to the body of the epididymis and seldom if ever involves the vas should be of aid. In a suspected case, careful physical examination of the patient for other evidence of syphilis should be made. Serology, spinal fluid examination in special cases, quantitative prolan determination of urine, blood sedimentation rate, tuberculin tests, and x-ray should fairly well establish the etiological agent. If all tests and examinations fail, a therapeutic test in those cases not already under antisyphilitic therapy may solve the problem. Even biopsy (as in the case reported here) may be needed for a conclusive diagnosis.

Treatment is that of the accepted antisyphilitic therapy of continuous alternate courses of a trivalent arsenical and bismuth. To hasten resolution, potassium iodide orally or sodium iodide intravenously is of great benefit, especially in those cases which develop while the patient is under antisyphilitic therapy.

The case presented here is atypical in two respects. First, this complication developed during the second course of mapharsen, 8 months after infection and with no break in the continuity of treatment. Second, this case cannot be classified as any of the definite clinical types. The onset was more or less chronic, but became acute, and during the acute phase gummata were present, as proven by biopsy.

CASE REPORT

J. A. M., F. 1c, U. S. N. Age 25. Admitted to the United States Naval Hospital, Washington, D. C., on August 14, 1940, with the diagnosis of epididymitis, acute, nonvenereal. On admission he complained of a painful swelling of the left testicle of 1 month's duration. Prior to admission the patient had been under ambulatory treatment in the form of support to the testicles. Since onset there had been a gradual increase in the size of the left testicle with little or no increase in the amount of pain. There was no radiation of pain, no recent history of loss of weight, hematuria, nocturia, dysuria, or urinary frequency. Other than the admission complaint, patient feels very well.

Family and personal history essentially negative. Past history revealed that patient had an injury to the left testicle at the age of 13–14 years which required hospitalization. Denied gonorrheal infection. On November 29, 1939, a diagnosis of syphilis was made, patient presenting a penile lesion of 6 days, duration. Serology was negative. Intensive antisyphilitic therapy was insti-

tuted on the date of diagnosis and has been continued to date. Total treatment received up to November 2, 1940; Mapharsen, 26 injections, 1.45 pm.; bismuch salicylate, 20 injections, 2.6 gm. In December 1939, serology became positive and remained so until March 1940. On July 16, 1940, or about the time of onset of present conditions, both Kahn and Wassermann reactions became positive and have remained so until present date.

Examination.—On admission the following positive findings noted: (1) Discrete and shotty enlargement of the superficial lymph nodes; (2) both epididymides were enlarged and painful, most marked on the left side. The left epididymis was markedly enlarged, hard, nodular, and painful to pressure. There was a small symptomless left hydrocele present. The right epididymis was slightly enlarged and indurated and not markedly painful to palpation. No clinical evidences of other tertiary lesions were present.

Impressions noted at admission:

     (1) Epididymitis, acute, nonvenereal.
     (2) Tumor testicle or epididymis.
     (3) Tuberculosis of epididymis.
     (4) Gumma epididymis.

Laboratory findings.—Complete blood count normal. Urine negative. Kahn positive. Wassermann strongly positive. Quantitative prolan determination less than 33 mouse units. Aschelm-Zondek negative. Repeated Aschelm-Zondek and tuberculin tests negative at a later date. One month after admission the reaction of the Kahn test had increased.

Progress notes.—After admission, every effort was made to improve the general health of the patient. Antisyphilitic therapy was continued. The lesion in the left epididymis progressed with increase in size and induration. One month after admission, symptoms shifted to the right epididymis, which became enlarged, indurated, nodular, and very painful. As no definite etiology had been established, a right epididymectomy was done on August 25, 1940. At this time a nodule about 2 centimeters in diameter was found in the globus major. The specimen was sent to the laboratory for pathological study. Following operation there was a normal convalescence. On August 26, 1940, the following pathological report was returned from the laboratory:

Pathological report.—Gross examination.—Specimen consists of three portions from right epididymis including oval yellowish nodule 2 centimeters in diameter. On section the surface is mottled yellow and brown.

Microscopical findings.—Sections from the nodule show a large necrotic center in which faint outlines of the dead tissue can be seen indicating coagulating necrosis rather than complete disintegration by caseation necrosis. Surrounding the necrotic area is a chronic inflammatory reaction consisting of fibrous tissue and epithelioid cell recticulum, which is invaded by large numbers of lymphocytes, and a few pus cells. There are scattered giant cell formations, but no proliferative or caseous tubercle formations are seen. Acid-fast stain is negative for acid-fast bacilli. Sections of epididymis show dilated ducts lined with normal epithelium and filled with granular secretion containing some spermatozoa. The blood vessels in the surrounding fibrous tissue show perivascular round cell infiltration.

Pathological diagnosis—Gumma epididymis.

Disposition of case.—Oral potassium iodide, 2 grams daily, was instituted. This type of therapy caused some symptomatic and clinical improvement. This drug was changed to sodium iodide intravenously daily for a period of 9 days with a daily dosage of from 5 to 10 grams. In this period the patient received a total of 67.5 grams. This treatment resulted in a rapid decrease in the size

and a softening of the diseased processes with symptomatic relief and an accompanying improvement in the general physical condition of the patent.

The patient was allowed 7 days' leave during which time he was free from symptoms. Examination revealed both testicles increased in density, with a noticeable decrease in pain sensation on the left side. The left epididymis appeared normal in size except for an indurated nodule at the lower pole. The right testicle was small and painful on pressure.

The patient reported for duty on November 5, 1940, but returned to this hospital for weekly observation and continuation of the antisyphilitic treatment.

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THE AIR AMBULANCE

By Lieutenant Commander Jesse G. Wright, Medical Corps, United States Navy

The transportation of the seriously ill and injured patients via airplane is a rapidly developing service, though not new. It was employed to a very limited extent during World War I. An air ambulance service was established in Australia during 1928 and is still carrying on an important work, transporting patients from the sparsely populated interior to medical centers. This service also included the location of several small, simple, pedal-operated wireless transceivers in the "outback" country for ready communication. The German army is reliably reported to be using this procedure on a large scale at the present time. During the early part of the present war 2,500 patients were reported evacuated from Poland to German hospitals and during this campaign German casualties were comparatively light. On the return trips the aircraft carried medical supplies and replacement personnel. The United States Navy has used aircraft for emergency ambulance work in isolated cases for many years.

In the event of war this practice would be greatly increased because of its many distinct advantages. The constantly increasing availability of planes of various types, plus the greater reliability, increased speed, and high degree of comfort, make this means far superior to any other yet devised. During naval or military opera-

tions, planes returning from the scene of action are usually without a military load and would have space available for injured or ill personnel.

At the present time the naval plane types suitable for this work are the patrol-bomber seaplanes, larger amphibians assigned to utility squadrons, and the large land transports used by the Fleet Marine Force. The patrol bomber seaplane type is by far the most numerous of the three, and being a seaplane, more likely suitable for removal of casualties from a naval or amphibious engagement. Their one limitation is the difficulty of landing and taking off in the open sea unless the water is relatively smooth. These planes have four or five bunks installed for the crew members which would be occupied by patients during flight. They could accommodate additional men on Stoke's stretchers, plus ambulatory patients to the limit of the planes' capacity and dependent also on the amount of fuel required for that particular flight. These planes are not heated and this is a difficulty if high altitudes or northern climates are encountered.

The land transports in use by the Fleet Marine Force, which are provided with a heating unit, can handle 7 to 10 stretcher patients depending on the type of transport available. In addition ambulatory patients may be carried up to the load capacity. These, being land-planes, are limited to areas where a suitable field for landings and "take-offs" is present.

The amphibian planes of the utility squadrons are heated, can land on either water or land, but do not have the load capacity of the above-described planes.

Before engaging in mass transportation of patients by air it is well to consider problems peculiar to aerial flight and the bearing they will have on the proper selection of patients. The table below shows the barometric pressure, partial pressure of oxygen and relative volume of saturated gases within the body at normal body temperatures in direct relation to altitude.

Altitude	Barometric pressure (MMs. Hg.)	Partial pressure oxygen (MMs. Hg.)	Relative gas volume
Seal level	760	152	1.0
10,000 feet	523	105	1.5
15,000 feet	429	86	1.9
20,000 feet	349	70	2.4
25,000 feet	282	56	3.0
30,000 feet	226	45	4.0
35,000 feet	179	36	5.4

From this table it can be readily seen that body gas volumes increase with ascent and also that unless oxygen is received from other sources, anoxemia will ultimately occur. These facts must be kept in mind when selecting patients for air ambulance service.

Pneumothorax, regardless of cause, is an example of a relatively large contained body of gas within the body. Boyle's law states that the temperature remaining constant, the volume occupied by a given quantity of gas is inversely proportional to the absolute pressure under which it is held. From the above table it can be seen that at 15,000 feet the volume of the pneumothorax would be 1.9 times sea level volume. Lovelace and Hinshaw have described the hazards of aerial transportation in patients having pneumothorax whether spontaneous, traumatic or therapeutic.

Penetrating wounds of the stomach and intestines should not be transported by air. The gastro-intestinal gases, subject to Boyle's law, will increase in volume as greater altitudes are reached and carry fecal material into the peritoneal cavity. Likewise patients with strangulated hernia or intestinal obstruction should not be transported at high altitudes as pointed out by Armstrong.

Pneumonia patients have always been moved with great reluctance. The difficulties of proper oxygenation of the hemoglobin are greatly increased by altitude and accompanying lowered oxygen pressure. In the event a pneumonia patient is to be moved by plane he should always be provided with oxygen breathing apparatus.

Head injuries with or without skull fracture, should be moved with care. Walsh has shown that the intracranial volume rises with ascent. Hence an aggravation of symptoms is to be expected upon reaching higher altitudes.

Anemic patients may have difficulty at increased altitudes. It must be remembered that subnormal amounts of hemoglobin will provide insufficient oxygen at higher altitudes and to prevent anoxemia, oxygen breathing apparatus must always be provided during flight.

Insane patients should be moved by plane only when under complete restraint. The mere presence of an attendant is inadequate to prevent a sudden violent act by the patient that could very conceivably be disastrous.

Regular Navy aircraft oxygen breathing apparatus is considered suitable for a conscious patient. It is standard equipment on the patrol bomber type. It is not at this time regular equipment on the other types described. The lack of weather reports and the potential enemy operations preclude the possibility of a definite flight plan. Hence it would be impossible to predict the altitude that would be encountered on any given trip, as done on a commercial air line schedule.

In the event that the Navy and Marine corps are supplied with large planes having sealed cabins to maintain atmospheric pressure nearer the sea level normal, it would greatly increase the scope of

air ambulance work. It would lessen the hazards of increasing body gas volume as well as the need for oxygen. These planes would also be supplied with heating units.

The question of designing, building, and maintaining special ambulance planes is debatable. The expense of new plane designs, the cost of separate maintenance, and the rapid obsolescence of modern aircraft seem to outweigh the advantages of somewhat greater comfort and some additional facilities. The additional factor of protection from attack must be considered. Modern warfare does not always follow the humanitarian rules laid down some years ago, and an ambulance plane would probably be a perfect target for some enemy patrol.

Patients by air ambulance should be accompanied by a trained attendant, a hospital corpsman, or, if the case warrants, a medical officer. In addition to oxygen-breathing apparatus other equipment available should include sterile needles and syringes with ampoules of various drugs ready for use. The value of the Stokes stretcher in transporting fracture cases, especially of the lower limbs, should not be forgotten.

In the writer's experience, properly selected patients are very comfortable even on relatively long flights. There is less discomfort to the patient from a 3-hour flight than from a 20-minute ambulance ride from the landing field to the hospital. With the exception of some of its older members, the naval service is a very air-minded group and looks forward to air transportation with enthusiasm. This has been true without exception in the several cases the writer has observed.

SUMMARY

1. Air ambulance service is a relatively old procedure that is growing rapidly abroad, and in the event of hostilities involving this country will prove of great value in our naval service.

2. Certain types of planes in use by the Navy at present can be used for this purpose.

3. Care must be taken in properly selecting cases for air transportation.

4. The procurement and maintenance of special ambulance plane types is discouraged.

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MODERN TECHNIC IN THE ANESTHESIA OF ABDOMINAL SURGERY

By Lieutenant Commander Richard B. Phillips,[1] Medical Corps, United States Naval Reserve

Apart from the surgery itself, anesthesia is the most important factor in aiding the surgeon to carry out good technique when operating within the abdomen. And conversely, an improperly conducted or an improperly chosen anesthesia may increase the surgeon's difficulties to such a degree that execution of the operation may be impossible.

I have specifically chosen to discuss the anesthesia of abdominal surgery for two reasons. First, abdominal operations comprise the great majority of all major surgery, and second, the technique of anesthesia in abdominal surgery has been enormously improved within the last 10 years. In the old days there was very little choice as to what was to be given, the usual procedure being to induce anesthesia with nitrous monoxide and then saturate the patient with ether by the open-drop method. Today, we have several types of inhalation anesthesia, and in addition, spinal, intravenous, and local block methods.

The desiderata in obtaining anesthesia in abdominal surgery are as follows:

1. Absence of pain.
2. Adequate relaxation of the abdominal muscles.
3. The use of an anesthetic agent, which, for the given operation ,will give anesthesia with the least effect upon the patient's physiologic equilibrium.
4. The anesthetic agent should be in a form which allows it to be administered in variable amounts, as necessary.
5. Signs of overdosage of the anesthetic agent should be readily discernible.
6. Postoperative effects of the anesthetic agent should be minimal.
7. The agent should not be too expensive.
8. The anesthetic agent should not be explosive.
9. The technique of administration of the given agent should not be too complicated.
10. There should be an adequate margin of safety, between surgical anesthesia and lethal planes.

There is not as yet any single anesthetic which fulfills all of the 10 requirements of the ideal agent mentioned above. However, with modern technique we now have single agents and combinations of agents which enable us to conduct anesthesia with satisfactory efficiency and at the same time with minimal insult to the patient,

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and with maximum aid to the surgeon. It is safe to say that without modern anesthesia the results which have been achieved in surgery would not have been possible. Today, we have a much greater responsibility as anesthetists, and the choice of anesthesia in a given instance may require great care and deliberation. The anesthetist of experience is now regarded as a consultant, on a par with the surgeon, instead of being a sort of bellhop as he was formerly, taking his instructions from the surgeon and working much in the order of an automaton.

We may divide anesthesia for abdominal surgery into five classes: (1) Inhalation, (2) spinal, (3) intravenous, (4) local block, (5) rectal (Avertin). I will not attempt to discuss in detail every variety and technique of anesthesia, but will confine myself to the principal techniques used at the Rochester General Hospital by my colleagues on the Anesthesia Service, Maj. John F. Kellogg, and Dr. S. LeRoy Sahler, and myself.

INHALATION ANESTHESIA

Cyclopropane is our choice for inhalation anesthesia in abdominal surgery. We have now administered this gas more than 9,000 times in the last 6 years, with very excellent results. An analysis of these particular cases is to appear in a forthcoming issue of the Journal of the American Medical Association. In the first year that cyclopropane was used at the Rochester General Hospital over 100 operations were done with this anesthetic. During 1940 we used it more than 1,650 times. It is the anesthetic of choice in 55 percent of our abdominal surgery. In only 6 percent of cases do we find it necessary to supplement the cyclopropane with ether on account of insufficient relaxation. Cyclopropane when administered in a concentration of 20 percent cyclopropane to 80 percent of oxygen will frequently cause apnea. In fact, we often wish to get an apnea when full relaxation is desired. One can control the apnea by passive respiration, i. e., by pressing gently upon the bag at intervals of 5 to 20 seconds, depending upon circumstances, and this procedure may be kept up for as long as half to three-quarters of an hour. When the patient has reached a depth of good surgical anesthesia under cyclopropane it is not necessary to continue the heavy concentration administered during induction. Very often one will obtain perfectly satisfactory anesthesia with a concentration of from 4 to 10 percent cyclopropane, the remainder being, of course, oxygen. The large amounts of oxygen which can be given with cyclopropane make this agent one of the very best, if not the best, anesthetic for patients with heart disease. There is practically no irritation of the bronchi or trachea, such as is so well marked in

ether anesthesia. Induction with cyclopropane is the easiest of all gases, and the patients have repeatedly told us that they have really enjoyed the experience. Postoperatively, it is a different story, however. There is very often considerable vomiting following cyclopropane, especially when it has been given for any length of time. I believe it is just as bad as one finds using ether. On the other hand, its good qualities more than make up for this unpleasant aspect of cyclopropane anesthesia. It is interesting to note that at the Rochester General Hospital we have operated upon more than 900 appendix cases within the last 2 years, using cyclopropane as the sole anesthetizing agent. The inflammable characteristics of cyclopropane is perhaps its worst feature, although we have had no explosions in over 9,000 cases to date. Most of the explosions reported have occurred in the presence of a cautery machine, diathermy apparatus, etc., which, of course, should not have been used with this type of anesthesia. Professor Horton of Massachusetts Institute of Technology has stated that as yet data is insufficient to indicate whether any one gas is more explosive than any other during anesthesia. For that matter, ether and nitrous oxide combination has exploded. One must pay attention, of course, to the accoutrement of the operating room, to the men in the room, and to the anesthesia machine in order to abolish, in so far as possible, explosion hazards.

I believe therefore that cyclopropane is the inhalation anesthetic of choice in abdominal surgery, alone, or in certain cases supplemented with ether.

INTRAVENOUS ANESTHESIA

This type of anesthesia, which is relatively new, is one of the finest contributions to anesthesia and to surgery that has appeared in the last 10 years. When I first used it, in 1933, in the Allgemeines Krankenhaus in Vienna, it was used in 50 percent concentration. We now use it in 2½ percent concentration according to the technique developed and popularized by Lundy of the Mayo Clinic. I have described the preparation of sodium pentothal and of evipal in the Military Surgeon for October 1940 and in the American Journal of Surgery for December 1940. Pentothal intravenous anesthesia has the following points in its favor:

1. It is not explosive.
2. Induction is very pleasant.
3. There are practically no post-anesthetic symptoms.
4. The technique can be mastered with moderate practice.
5. It can be used when inhalation anesthetics are contraindicated—mouth, certain lung operations, jaw surgery, etc., etc.
6. Adequate relaxation can be obtained under pentothal for abdominal surgery.
7. It is easily transportable and is inexpensive.
8. It is of special value as a complement to spinal anesthesia.

The following points are against this type of anesthesia:

1. Respiratory depression is almost a constant finding with surgical anesthesia.
2. Oxygen and oxygen apparatus must be available for use.
3. Intravenous anesthesia is best done by an anesthetist plus an assistant who looks after the airway and the administration of oxygen.

Intravenous anesthesia is well suited for short operations within the abdomen, such as dilating fecal fistulas, the operation of loop colostomy, biopsy, and operations upon the abdominal wall. Thousands of appendices have been removed under pentothal sodium alone. I have personally given pentothal for three gastro-enterostomies in combination with local block anesthesia of the abdominal wall. I am not in favor of using pentothal in abdominal surgery excepting in those cases in which inhalation or spinal anesthesia is contraindicated. Pentothal is of great value in association with spinal anethesia, as I shall describe shortly. It is wiser to reserve pentothal anesthesia for short cases, ones which do not require complete relaxation, such as for example cystoscopy, for which it is ideal, and dilatation and curettage of the uterus, which is another excellent indication for intravenous anesthesia. Pentothal has been used for everything in abdominal surgery, including resection of part of the colon, but as I have said, it is wiser to reserve it for special types of surgery not of too major a degree. I have discussed the use of pentothal sodium at greater length in an article entitled "Wartime Anesthesia" which is soon to appear in War Medicine.

SPINAL ANESTHESIA

This is the anesthesia par excellence for abdominal surgery. There has been a greatly increased interest in spinal anesthesia during the last few years, due to the development of newer techniques of administration, possessing greater degrees of safety. Relaxation is greater under spinal anesthesia than with any other. At the Lahey Clinic practically 100 percent of the abdominal surgery is done under spinal anesthesia.

Of the many preparations used in spinal anesthesia I will mention spinocaine, neocaine, metycaine, procaine, novocaine, nupercaine, and pontocaine (niphanoid). It is important to consider the following aspects of every case in which spinal anesthesia is to be used:

1. Weight of drug used in comparison to specific gravity of the spinal fluid.
2. Dose of the drug which is to be injected.
3. Estimated time of the operation.
4. Type of surgery which is being done.
5. Age and weight and general strength of the patient.
6. Position of the patient during surgery, i. e., Trendelenburg, on side, chest, etc.
7. Psychic make-up of the patient.

Obviously if a preparation such as spinocaine is to be used, which is lighter than spinal fluid, then the patient's head and shoulders must be kept at a lower level than the torso and pelvis. If a preparation such as metycaine is being used, which is heavier, then the patient's head must be elevated slightly on a pillow in order to protect the medulla from the anesthetic agent. Other factors which operate in the distribution of spinal anesthesia are (1) the speed of injection of the drug, (2) the amount of spinal fluid mixed with the drug, and (3) the space (lumbar) which is selected for injection. No matter what drug is being used it is always wise to introduce into the syringe an equal quantity, at least, of spinal fluid. This is to ensure proper mixing of the agent with spinal fluid and to avoid patchy distribution of anesthesia. It also prevents the patient from receiving too great an insult to his vasomotor system, as the greater dilution will decrease the likelihood of sudden spinal shock.

It should be realized, and it generally is not, that an ampoule of any spinal anesthesia preparation is the full maximum dose to be administered. Some men give the entire contents of an ampoule to every case no matter what is being done. As a rule one should seldom give more than three-fourths of the maximum dose for any type of surgery, unless it is a long procedure and the patient is in excellent health. Metycaine for example comes in 2 cc. ampoules containing 200 mgm. The average dose for an hysterectomy is approximately from 125 to 160 mgm. Procaine is given in similar amounts, and also comes 200 mgm. to the ampoule. Spinocaine is 300 mgm. to the ampoule, and pontocaine (niphanoid) is 20 mgm. This latter preparation is my favorite agent, and I always use glucose 10 percent with it, to make the final solution heavier than spinal fluid. Ten mgm. is quite sufficient for an operation such as hemorrhoidectomy, perineorraphy, etc. Fourteen mgm. is usually entirely satisfactory for an operation such as an hysterectomy, appendectomy, or an unilateral hernia. For operations upon the upper abdomen, such as cholecystectomy, or gastric surgery, one must use from 16 to 19 mgm. I dissolve the crystalline powder by introducing 3 cc. of 10 percent glucose into the ampoule, and then, after estimating the dose needed for the surgery, the excess is expelled from the syringe before the required amount is injected into the spinal canal. I have found that niphanoid (crystalline pontocaine) will last for 2 hours in the majority of instances.

Naturally, preoperative medication is of the greatest importance in spinal, as in any other type of anesthesia. I always use morphine $\frac{1}{6}$ to $\frac{1}{4}$ grains plus nembutal grains $1\frac{1}{2}$, seconal grains $1\frac{1}{2}$, or some other barbiturate. Atropine is used in nearly every case. In particularly nervous individuals, I often use hyoscine grains $\frac{1}{200}$ in addition to the

above named drugs, but omitting atropine. I have never found it necessary to give a patient intravenous anesthesia in order to put him to sleep before administering the spinal anesthetic, and I do not believe that this should be done. On the other hand I very often give patients, after administration of the spinal anesthetic, small amounts of intravenous anesthesia to put them to sleep. One can control neausea with pentothal very nicely, as the patient simply goes to sleep on a dose which is far below anesthetic depth. The use of pentothal as a complement to spinal anesthesia when the patient is regaining sensation at the end of an operation, is of the greatest value. It is usually not necessary to give the patient more than a moderate dose of pentothal intermittently, as a supplement to spinal anesthesia, usually between 500 to 800 mgm. I like this technic, so I always have pentothal available for every case in which I use spinal anesthesia. As I stated before, I use the 2½ percent solution, dissolving the 1,000 mgm. ampoule of pentothal by adding to it 40 cc. of distilled water. This will make up two 500 cc. syringes of pentothal 2½ percent, and all that is necessary in addition is a No. 19 needle, a tourniquet, arm board, and accessories for venipuncture. It is a good good idea to put the arm on an arm board at the beginning of the operation. The internal malleolar veins may also be used.

The administration of plasma, blood, saline, and glucose, is a *sine qua non* to correct spinal anesthesia—not in every case, to be sure, but these shock-preventing agents should be available and should be used before the patient has reached a state of even moderate shock. Naturally one watches the pulse, blood pressure, and respiration, with great care throughout an entire spinal anesthesia. Oxygen should always be available to assist in raising the oxygen intake for a patient who has had partial respiratory paralysis, a not infrequent complication of spinal anesthesia. The very first few minutes are the most important in determining the level of anesthesia. After 5 or 6 minutes following injection, the drug becomes fixed upon the nerve roots, arachnoid, and dura, and one can no longer raise the level of anesthesia. In using niphanoid, for example, one can put the table in reverse Trendelenburg should the level seem to be too high, or one can lower the head and allow the heavier-than-spinal-fluid preparation to flow cephalad should the level appear to be not high enough for the surgery which is to be undertaken. While these steps are being done, one must test the patient's skin with forceps constantly.

In abdominal surgery we can place spinal anesthesia first, I believe, as being safest and most useful. Then comes inhalation anesthesia,

and lastly intravenous. Spinal still is not being used as much as it will be in the future, because there is some moderate amount of trouble and bother in getting the equipment together, and it is so much easier, in many instances to slip a mask on the patient's face and start inducing anesthesia. Surgeons should not give their own spinal anesthesias unless so required by circumstances. When spinal "shock" occurs, one needs the full attention of an anesthetist, and the surgeon has all he can do with his operation. Spinal anesthesia will well repay for whatever inconvenience the giving of it may cause. Eighty-eight percent of our patients at the General Hospital in Rochester who have had spinal anesthesia tell us that they would have it again if they had to have another operation. Pulmonary complications are no greater; in fact, in my experience, they are less with spinal anesthesia when compared to inhalation agents.

Abdominal wall block is a very useful procedure in conjunction with either intravenous or with general anesthesia. One can often secure adequate anesthesia to enable the abdomen to be opened and explored before beginning general anesthesia. In debilitated patients, one can by this means frequently cut down the time of general anesthesia very considerably. I usually use 200 cc. of a 1 percent solution of metycaine for most abdominal block anesthesias, using extra long needles, and infiltrating widely and deeply.

Rectal avertin has a definite place as a basal anesthetic agent in conjunction with spinal or general anesthesia. One uses from 70 to 100 mgm. per kilo of body weight, depending upon the patient's weight, condition, and the operation to be done. Avertin is of exceptional value in combating excitement, nervousness, and its use will enable us to bring the patient to the operating room asleep, or very drowsy. It does constitute an additional hazard, however, and one should keep the dosage on the lighter side. It should not be used alone. It is of special value to patients suffering from hyperthyroidism who have to have abdominal operations.

CONCLUSIONS

Certain newer technique in the administration of cyclopropane, spinal and intravenous anesthesia has been discussed.

With careful technique and assiduous attention to detail, spinal anesthesia is recommended as being the ideal anesthesia for abdominal surgery.

The great value of pentothal sodium intravenous anesthesia is considered.

Cyclopropane is recommended as the best inhalation agent for anesthesia, now available.

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CLINICAL NOTES

FRACTURE OF MAXILLAE AND MANDIBLE[1]

TWO CASE REPORTS

By Commander A. H. Yando, Dental Corps, United States Navy, and
Lieutenant Commander R. W. Taylor, Dental Corps, United States Navy

The Winter and similar types of fracture appliances have been employed primarily to immobilize the fractured mandible. However,. these appliances may be used to great advantage in the treatment of other types of fractures. By way of illustration, two cases involving these appliances are presented.

CASE 1

History.—A. J. S., P. F. C., U. S. M. C. while riding a motorcycle, met with an accident which resulted in multiple fractures of the maxillae and mandible. He was admitted to this hospital[2] in a semiconscious condition.

Clinical oral examination.—Marked edema in soft tissues of face and neck. Lacerations about face. Vertical compound fracture of right maxilla extending through cuspid region to soft palate. Transverse fracture of both maxillae, resulting in considerable downward and backward displacement. Several anterior teeth evulsed. Vertical compound fracture of mandible located between left lateral incisor and cuspid teeth. Left side of mandible greatly depressed.

Roentgenographic examination.—Bilateral horizontal fracture of maxillae located on a plane with inferior border of malar bones. Longitudinal fracture through right palate. Wide separation of fragments. Vertical fracture through body of mandible in cuspid area on left side. Neck of left condyle fractured.

Treatment.—Under local anesthesia and a narcotic, the following procedures were instituted: The fracture in the body of the mandible was reduced and fixation of fragments maintained by use of a Winter arch splint ligated to the mandibular teeth. Reduction of this fracture reestablished a correct relationship between the condyle and ramus, making further treatment unnecessary. The normal contour of the mandible offered a guide for the subsequent reduction of the displaced fragments of the maxillae. A Winter arch splint with a vulcanite extension having an ordinary threaded nut embedded, was vulcanized to the center of the arch. (A supply of these splints with vulcanite attachment is kept on hand.) (Fig. 2.) This appliance was loosely adapted to the maxillary teeth. The left maxillary teeth were placed in original occlusion with the left mandibular teeth and the Winter splint tightly ligated to the left maxillary dental arch. The left maxilla was then securely fastened to the left side of the mandible with elastics. This operation was repeated on the right side thus reestablishing the original occlusion.

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After restoring displaced bones to their former anatomic relationship in certain types of fractures, some means of extraoral fixation must be devised to maintain this position. The type of extra-oral appliance used in this case was developed in the Navy and has been employed successfully for the past 6 years. The appliance consists of a horizontal bar embodying the principles of the Snow face bow. To this bar are fastened two vertical bars which pass upward on either side of the face to contact the bars embedded in a plaster head cap. These vertical bars are attached to the horizontally embedded bars of the cap by adjustable lock nuts, thereby allowing vertical movement of the appliance. The attachment on the Snow face bow offers a wide latitude of movement and is an important factor in the final reduction of the fractured maxillae. (Fig. 1.)

The maxillae with the mandible attached were gradually maneuvered into a correct anatomic position. This position was attained with the aid of roentgenograms, palpation and observation of facial contour. The threaded bar of the Snow face bow was screwed into the nut on the Winter arch and locked, as were the two lock nuts near the head cap, thus assuring complete immobilization. (Fig. 3.)

Results.—The appliance was removed after 8 weeks and recovery was uneventful.

COMMENT

1. (*a*) The construction of vulcanite and cast metal splints consumes much valuable time.

(*b*) Impressions are necessary but frequently difficult to obtain.

(*c*) These splints usually cover the occlusal surfaces of the teeth thereby preventing, in many cases, reestablishment of the original occlusion.

(*d*) Bulky appliances are difficult to keep clean and are in many instances detrimental to the underlying soft tissues.

2. (*a*) The Winter and similar arch splints are easily adapted, simple to clean and when properly used, of little damage to surrounding tissues.

(*b*) They permit teeth to resume their original occlusion.

3. When both maxillae and mandible are fractured, an extraoral appliance assuring the fixation of the fragments should be employed. The above appliance, simple in design, meets this requirement.

CASE 2

History.—D. M. M., F. 2. C., U. S. N. as a result of an automobile accident, suffered a compound fracture of the left side of the mandible. Emergency treatment had been administered at the time of the accident. The patient came under our care 1 week later.

Clinical oral examination.—Teeth were in good occlusion and mandible immobilized by the use of intermaxillary wiring. Palpation, however, revealed
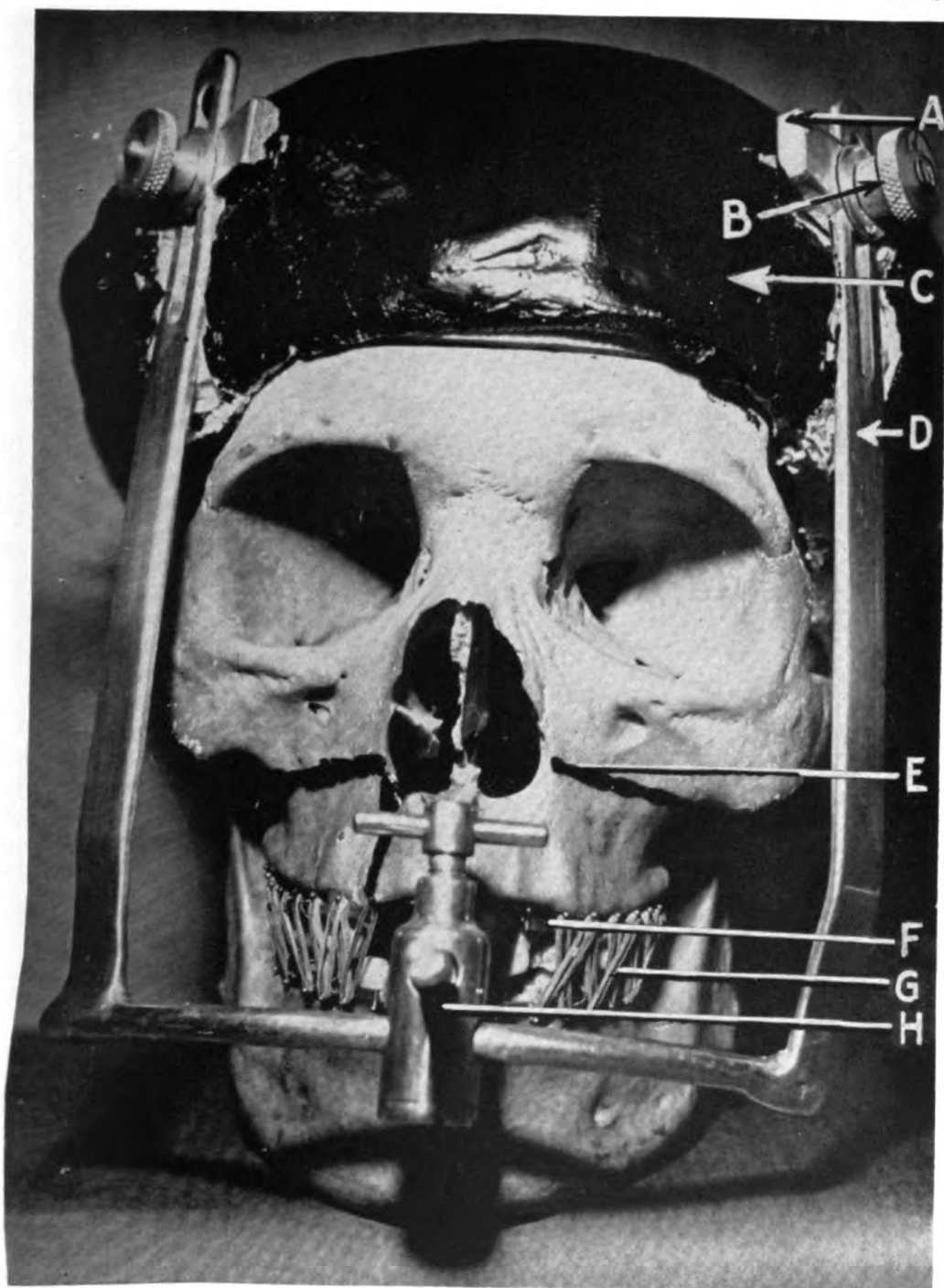
FIGURE 1.—EXTRA-ORAL APPLIANCE CONSTRUCTED OF DURALUMINUM.

A. Horizontal bar.
B. Lock nut.
C. Plaster head cap.
D. Vertical bar.
E. Fracture lines.
F. Winter arch splint.
G. Rubber ligatures.
H Attachment of Snow face bow.
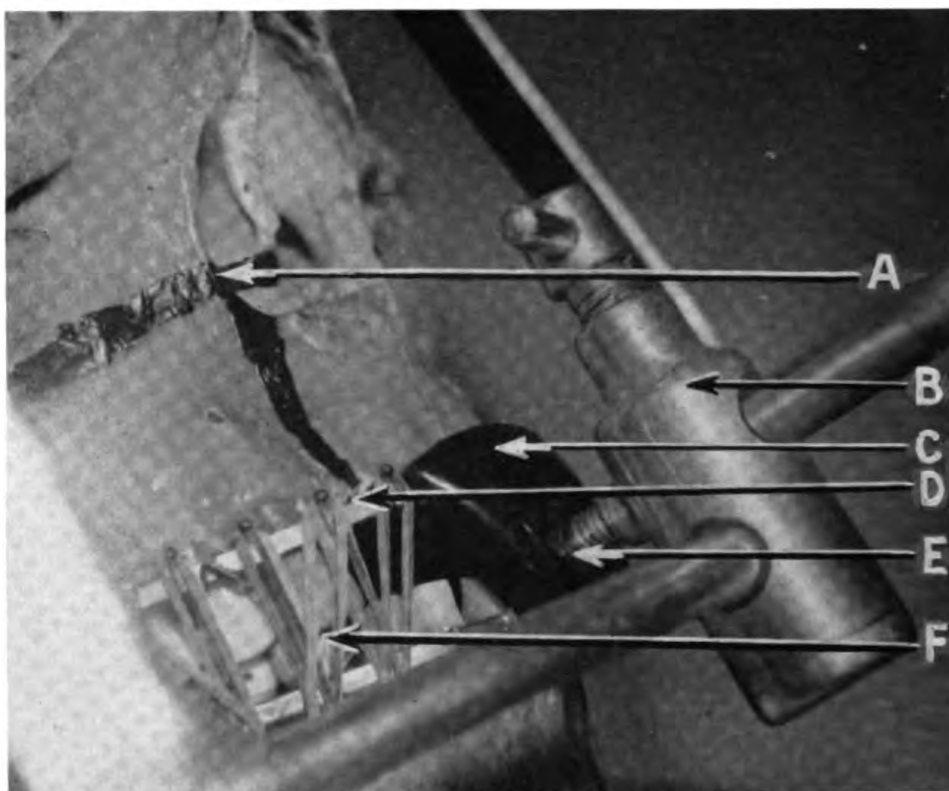
FIGURE 2.

A. Fracture lines.
B. Snow face bow attachment.
C. Vulcanite extension.
D. Winter arch splint.
E. Embedded nut.
F. Elastics.

FIGURE 3.—APPLIANCE ON PATIENT.
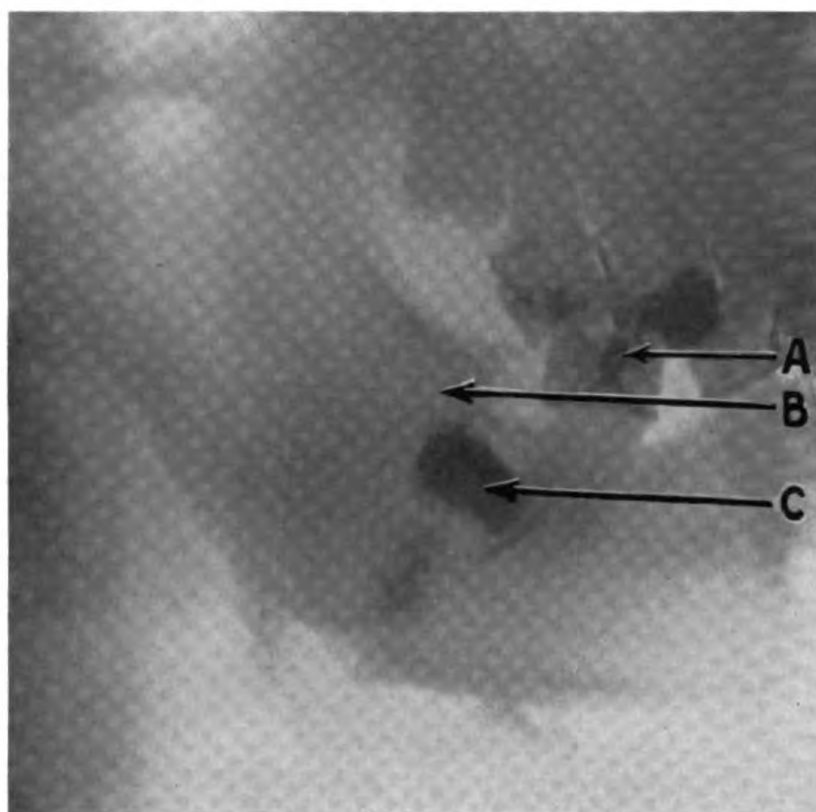
FIGURE 4.—FRACTURE BEFORE REDUCTION.

A. Intermaxillary wires.
B. Displaced posterior fragment.
C. Embedded tooth in line of fracture
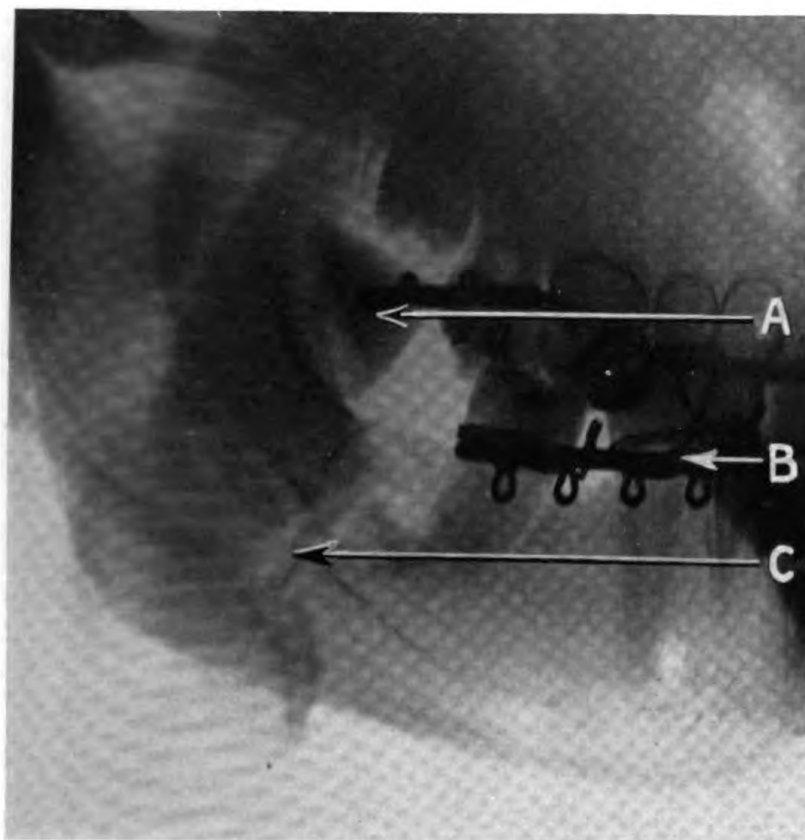
FIGURE 5.—AFTER REDUCTION.

A. Vulcanite saddle
B. Intra-oral splint (Jelenko).
C. Line of fracture, tooth removed.
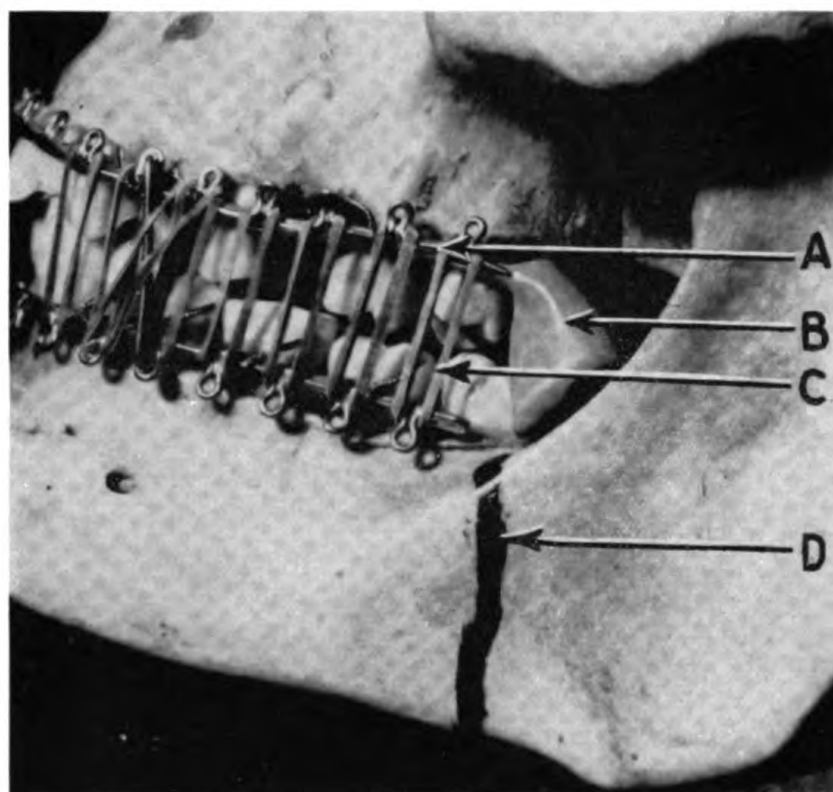
FIGURE 6.—ILLUSTRATION OF APPLIANCE ON MODEL.

A. Jelenko arch splint.
B. Vulcanite saddle.
C. Rubber ligatures.
D. Fracture line.

considerable upward and outward displacement of the posterior fragment (ramus). Mild edema of soft tissues at angle of the jaw.

Roentgenographic examination.—A vertical fracture was revealed extending from the superior border of the body of the mandible to its inferior border, distal to the second molar tooth. An unerupted developing third molar was located in the line of fracture. There was an overriding of the posterior fragment with considerable upward displacement. (Fig. 4.)

Treatment.—Under conduction anesthesia, the intermaxillary wires were removed and the third molar extracted. A Jelenko arch splint was adapted and ligated to the mandibular teeth. The same type of splint, with a saddle vulcanized to the left end of the arch, was attached to the maxillary teeth. The left posterior portion of this splint was allowed to project slightly beyond the tuberosity. The fracture was reduced and teeth were placed in their original occlusion. This relationship was maintained by intermaxillary elastics. The saddle of the maxillary arch was bent downward so that it rested lightly on the posterior fragment, preventing its displacement. (Figs. 5 and 6.)

Results.—The appliance was removed after 3 weeks and recovery was uneventful.

COMMENT

This intra-oral method of maintaining the correct position of the posterior fragment when force is necessary, is very simple and eliminates the use of more complicated extra-oral procedures.

THE SURGICAL TREATMENT OF PROGNATHISM [1]

CASE REPORT

By Captain Frederick R. Hook, Medical Corps, United States Navy, and
Lieutenant Commander Ralph W. Taylor, Dental Corps, United States Navy

Prognathism is a deformity characterized by an abnormal protrusion of the mandible. The resultant malocclusion seriously interferes with mastication and usually presents a displeasing appearance.

Three methods of treatment of this condition are described, i. e. orthodontic, surgical and prosthetic. A combination of these methods may be employed.

If the method of choice is surgical, repositioning of the mandible may be accomplished by either osteotomy or ostectomy. Osteotomy involves division of the ramus and shifting of the body of the mandible backward to the desired position, followed by immobilization until adequate healing takes place. Ostectomy consists in the removal of a section of the mandible. The mandible is then repositioned so that the teeth are restored to normal occlusion.

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[1] Received for publication May 1941.

CASE REPORT

History.—C. F., Pvt., U. S. M. C., 6 months ago received a bilateral fracture of the mandible. Patient admitted to this hospital[a] with a diagnosis of malunion.

Oral clinical examination.—Patient exhibited a typical class III malocclusion. (Fig. 1A, 3A, 3B).

Radiographic examination.—Fracture lines were still faintly visible in the mandible but there was evidence of consolidaton. The mandibular third molar teeth were impacted.

Preoperative treatment.—Study casts were made of the case, in order that the direction of the saw cuts could be accurately gauged. To facilitate the repositioning of the mandible, certain teeth were spot ground. Arch wire splints were then ligated to the maxillary and mandibular teeth.

Treatment.—In this case osteotomy was indicated. The premedication of patient was accomplished by the use of morphine ¼ grain and sodium pentobarbital 3 grains. Anesthesia was obtained by using intra-orally, inferior dental bilateral conduction with supplemental infiltration of tissues on the internal surface of the rami in the region of the sigmoid notch. Extra-orally infiltration anesthesia was used at the site of the incision. The anesthetic used was a 2 percent solution of procaine hydrochloride.

A vertical incision approximately 1½ inches was made in front of the ear extending from the tragus to the lower border of the lobe. Using blunt dissection to prevent injury to the facial nerve and blood vessels, the parotid gland was pushed aside and the posterior border of the ramus was exposed. A curved threaded needle was introduced at the posterior margin of the ramus and passed along the internal surface until the anterior border was reached, at which point the needle was forced .through the skin. Care was taken so that the needle passed between the sigmoid notch of the ramus and the mandibular canal. The needle was kept in close proximity to the bone in order that the inferior alveolar artery and nerve, which traverse the mandibular canal, were not severed. Penetration into the oral cavity was carefully avoided. A Gigli saw was attached to the needle, and the needle pulled through, carrying the saw with it. Handles were attached to the saw, and the ramus cut through. (Fig. 2A.) Wound incisions were then sutured. This whole procedure was repeated on the opposite side.

The mandible was repositioned and the new relationship maintained by intra-oral fixation. (Fig. 2B.) Rubber ligatures were used to immobilize the mandible. Fixation of mandible was maintained for a period of 5 weeks.

After the removal of the arch wire splints certain teeth were ground for the purpose of obtaining better occlusion. Casts (Fig. 1B) and photograph of patient made after operation. (Fig. 3C, 3D.)

COMMENT

The photographs show the excellent result obtained on this case. As has been previously pointed out, osteotomy was indicated here due to the necessity of dividing the ramus in order to get the correct reposition of the mandible.

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[a] United States Naval Hospital, Washington, D. C.
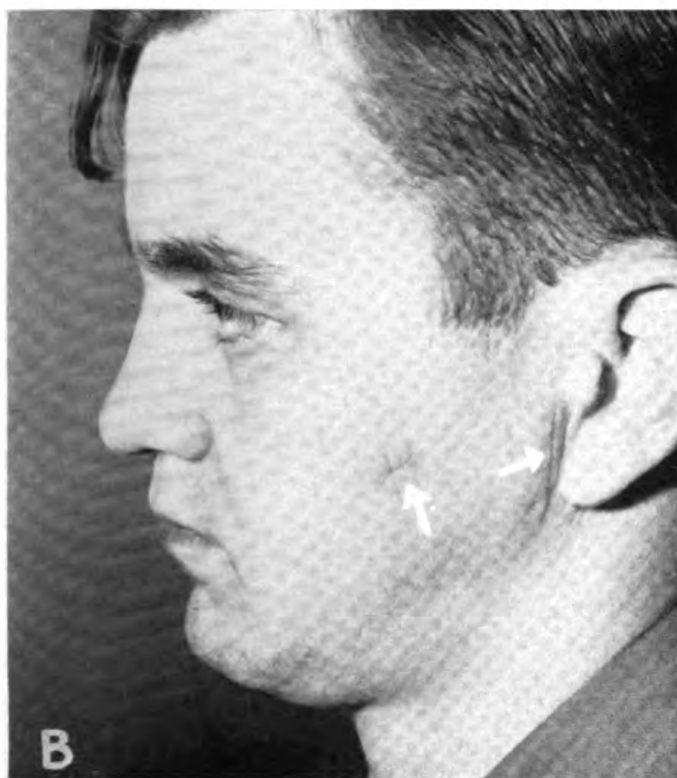
FIGURE 1.
A. Before operation.
B. One week after operation.
(Note lines of incision indicated by arrows.)
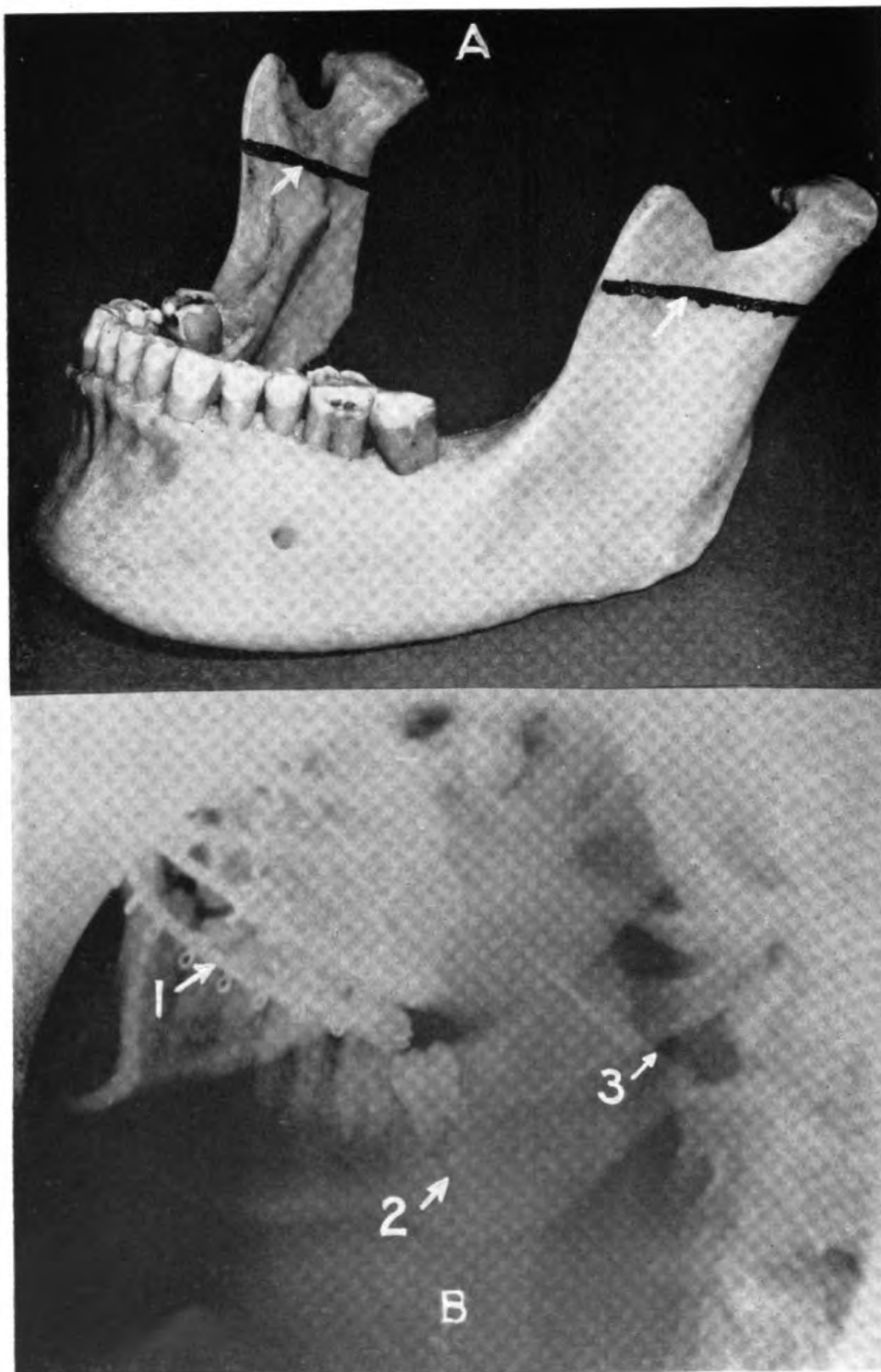
FIGURE 2.

A. Lines denote division of rami.
B. 1. Intra-oral splint.
   2. Old fracture line.
   3. Body of mandible shifted backward to desired position.

PLATE 17
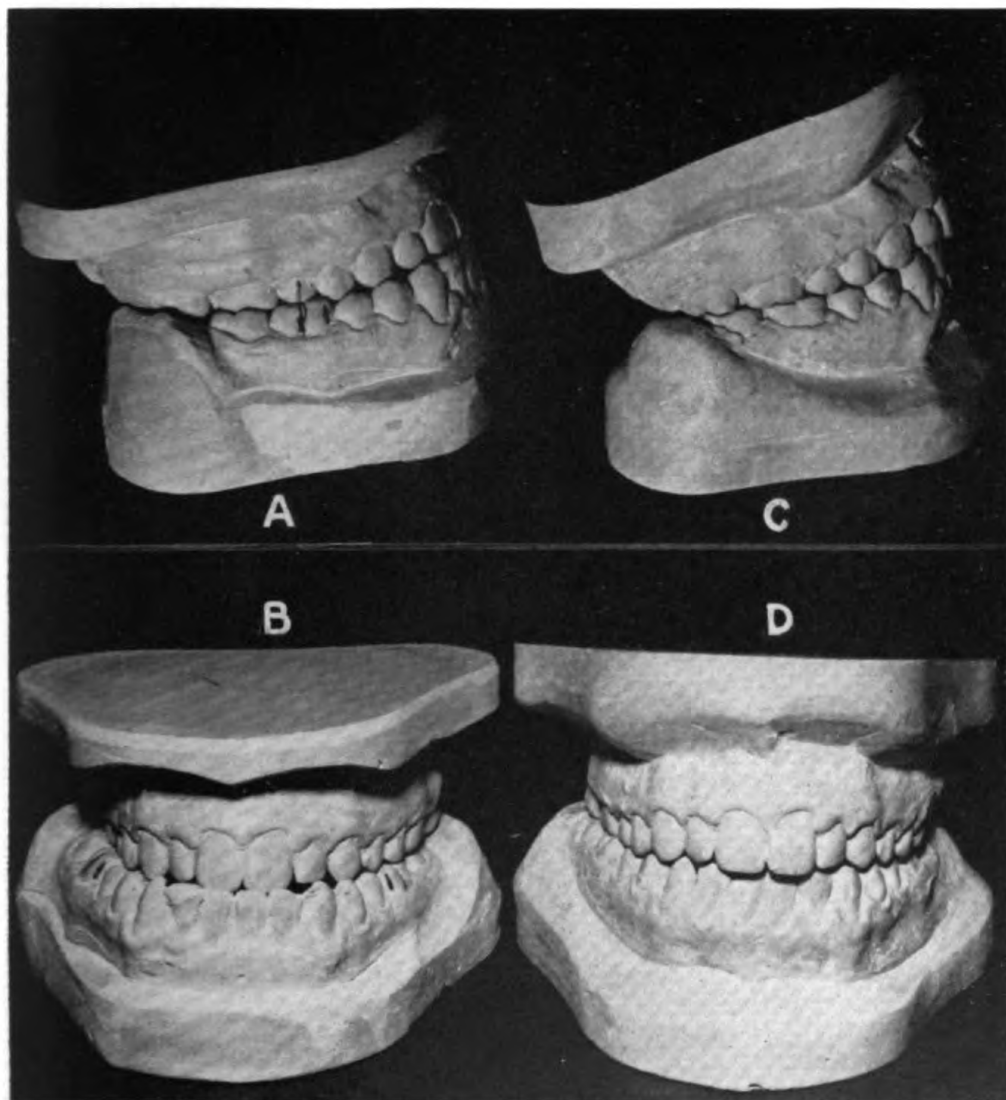
FIGURE 3.—LATERAL AND ANTERIOR VIEWS.
A. B. Occlusion of the teeth before operation.   C. D. Following operation.

AMEBIASIS

REPORT OF AN UNUSUAL CASE*

By Lieutenant Commander John M. Berkman, Medical Corps, United States Naval Reserve, and Commander Thomas B. Magath, Medical Corps, United States Naval Reserve

For many years emetine hydrochloride has been used empirically, and in certain cases results have been good although the presence of amebiasis was not definitely proved. Early in this decade many deaths occurred after operations on patients who were suffering from amebic infection which had not been recognized prior to operation. However, in some instances when the presence of amebiasis was suspected either at the time of operation or shortly after, rather dramatic and favorable results followed administration of emetine hydrochloride.

This case is reported as an example of the dramatic effect of emetine hydrochloride in an instance in which the clinical symptoms did not suggest amebiasis; Endamoeba histolytica had not been identified, although several stools had been examined. The appearance of the abdominal organs at exploration was the first finding to suggest the presence of amebiasis.

CASE REPORT

The patient, a woman 61 years of age, first registered at the Mayo Clinic July 24, 1939. At that time her principal complaint was aching of the knees. She also gave a history of mild, dull aching pain in the epigastrium and in the right lower quadrant of the abdomen which occurred after meals and when she was fatigued. These symptoms had not been sufficiently severe to cause her concern. A few months before registration she had begun to notice more fatigue and had felt depressed. She had not had any symptoms referable to the bowel or other associated and significant symptoms.

Physical examination, routine laboratory tests, and roentgenograms of the thorax, stomach and gall bladder revealed nothing abnormal with the exception of slight essential hypertension, occasional extrasystoles and a tendency to obesity. Because of the minor character of the patient's complaint, her appearance of good health and the absence of significant findings she was dismissed from the clinic and it was felt that any serious disease had been excluded.

On February 5, 1940, 7 months after her first admission, the patient was brought to the clinic by ambulance. She related that she had been active subsequent to her dismissal from the clinic in July 1939, and, with the exception of fatigue, had no other complaints. In November 1939, she had noted that she was tiring more easily than usual; at that time a mild, dull, aching pain in the right side of the abdomen and across her shoulders posteriorly had begun. At times she had experienced pain in the thorax on respiration. The pain gradually became worse until it was severe across the shoulders and in

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the right side of the abdomen. It had become necessary for her to use heat
and sedatives in order to obtain relief. After 7 or 8 weeks, during which
time she had been ambulant, the pain became so distressing that she had
entered a hospital. At that time she began to cough, experienced chilly sen-
sations, and perspired considerably. Anorexia was rather marked. Her weight
in July 1939, had been 185 pounds (84 kg.) ; 6 months later it was 145 pounds
(66 kg.). The physician in her home locality noted enlargement of the liver.
The temperature was about 102° F.; leukocytes numbered 12,000 to 15,000 per
cubic millimeter of blood and the sedimentation rate was 125 mm. in an hour.
Rather extensive laboratory search, including examination of the stools, the
tests of hepatic function and roentgenograms of the stomach and colon did
not reveal any abnormality.

On admission to the clinic on February 5, 1940, the patient complained prin-
cipally of constant, distressing pain across the shoulders posteriorly and pain
in the right side of the abdomen. She was extremely weak and perspired
profusely. Although the pain across the shoulders was severe and constant,
it did not increase at night. On examination the entire abdomen was tender
and especially so in the upper right quadrant; the liver was markedly enlarged
and extended downward to the level of the umbilicus. Her appearance and
degree of illness strongly suggested the presence of a malignant lesion.

During the week of investigation the temperature varied from 101° to 102°
F. each day. The value for hemoglobin was 52 percent; leukocytes, counted
daily, numbered from 11,000 to 15,200 per cubic mm. of blood; the sedimenta-
tion rate was 124 mm. in an hour. Parasites or ova were not found on examina-
tion of two natural stools. The bromsulfalein test of liver function showed a
retention of dye, grade 2; the van den Bergh reaction was indirect and the
concentration of bilirubin was less than 1 mg. per 100 cc. of serum. The right
side of the diaphram was elevated as disclosed by roentgenograms of the
kidneys, ureters, and bladder; shadows of the psoas muscles were visualized
bilaterally. Roentgenologic examination of the diaphram revealed an absence
of the expiratory excursion. Roentgenograms of the thorax revealed that the
right side of the diaphram was elevated to the seventh rib posteriorly and that
the pericardium and diaphram were adherent to the pleura on the left. Exten-
sive, interlobar pleuritic bands were present at the bases of both lungs. It
was felt that the bilateral involvement suggested an inflammatory lesion rather
than a malignant one.

Roentgenograms of the colon, daily urinalysis, and blood cultures revealed
nothing abnormal, and examination of the blood smear revealed toxicity of
erythrocytes only.

Analysis of findings.—The positive findings were: (1) Continuous leukocytosis;
there were more than 15,000 leukocytes per cubic millimeter of blood before the
patient registered at the clinic; (2) persistent daily fever of 101° to 103° F.;
(3) enlargement of the liver to the level of the umbilicus; (4) an elevated and
fixed diaphram; and (5) rather extensive but indeterminate findings at the bases
of both lungs as depicted in roentgenograms of the thorax. Owing to the
presence of persistent fever and continuous leukocytosis, it was necessary to
exclude certain conditions in the differential diagnosis. In the absence of
other suggestive history and findings and with good visualization of the shadows
of both psoas muscles it was felt with some certainty that the possibility of a
perinephritic abscess could be disregarded. Because the pain across the shoul-
ders was not worse at night, it was felt that root pain could be excluded as a
causative factor. The possibility of a pyogenic abscess of the liver was con-

sidered. However, if the patient had suffered from a pyogenic abscess of the liver for 3 months it seemed that a more active and more rapid progression of illness would have occurred.

In view of these symptoms and findings and of the degree of illness, it was felt that the best procedure would be to explore the upper right quadrant of the abdomen and to keep the possibility of a subdiaphragmatic abscess in mind.

Findings at exploration.—On February 14, 1940, exploratory operation was performed. The liver was markedly enlarged and reached to the level of the umbilicus. It was necessary to separate the liver from the diaphram because of many hemorrhagic adhesions. The dome of the liver was explored completely and no abscess was found. The edge of the liver was round and firmly adherent to the anterior and lateral thoracic walls. The liver was definitely purplish. The left lobe of the liver was enlarged to the extent that it was comparable in size to the right lobe. While there was some edema around the gallbladder, which was buried in adhesions, stones could not be felt. Subacute appendicitis and marked periappendicitis were found. This inflammation extended into the wall of the cecum which was markedly thickened into the ascending colon. Edema and thickening of the mesentery of the appendix were marked. Specimens of bloody mucus which were encountered in separation of the liver from the diaphram were taken for bacterial culture.

From the appearance of the structures of the right lower quadrant of the abdomen and from the symmetrical and apparently inflammatory enlargement of the liver, the presence of amebiasis was suspected. It was suggested that the appendix and tissue be examined for Endamoeba histolytica. However, with the staining methods used in the routine pathologic examination, evidence of amebic infection was not found. The pathologic diagnosis was subacute appendicitis associated with periappendicitis. Study of cultures made from the bloody mucus and appendix disclosed gram-negative bacilli.

Postoperative data.—On the day after operation the patient's temperature rose to 102° F., which had been a usual occurrence. Nothing that could not be readily attributed to the operation the day previous was observed. During the night the temperature began to rise and on the morning of the third postoperative day the temperature was 104° F. Owing to the preoperative thoracic findings, both clinically and roentgenologically, the possibility of pneumonia was considered. Because of her degree of illness and also because of the appearance of the liver at the time of operation, it was decided to use both sulfathiazole (2-sulfanilamidothiazole) and emetine hydrochloride. Administrations of sulfathiazole were given for 2½ days and then discontinued. One grain (0.065 gm.) of emetine hydrochloride was given twice daily for 3 days. The temperature fell from 104° F. to normal within 24 hours after the first dose of emetine hydrochloride and remained so for the rest of the patient's stay in the hospital (fig. 1).

The pain in the right flank continued for a week, then disappeared. The pain across the shoulders posteriorly continued to be distressing and was not relieved by application of heat. Two weeks after operation this pain also disappeared; it seemed to have been due to diaphragmatic irritation.

Because of the precipitous fall in temperature after administration of emetine hydrochloride, it was decided to continue its use in spite of lack of definite evidence of amebiasis. Consequently, after 6 grains (0.4 gm.) of emetine hydrochloride had been administered, 1 tablet of treparsol was given 3 times daily for 4 days. This was followed by a second course of 4 grains (0.26) gm.) of emetine hydrochloride and 1 week later a second course of 12 tablets of treparsol was given.
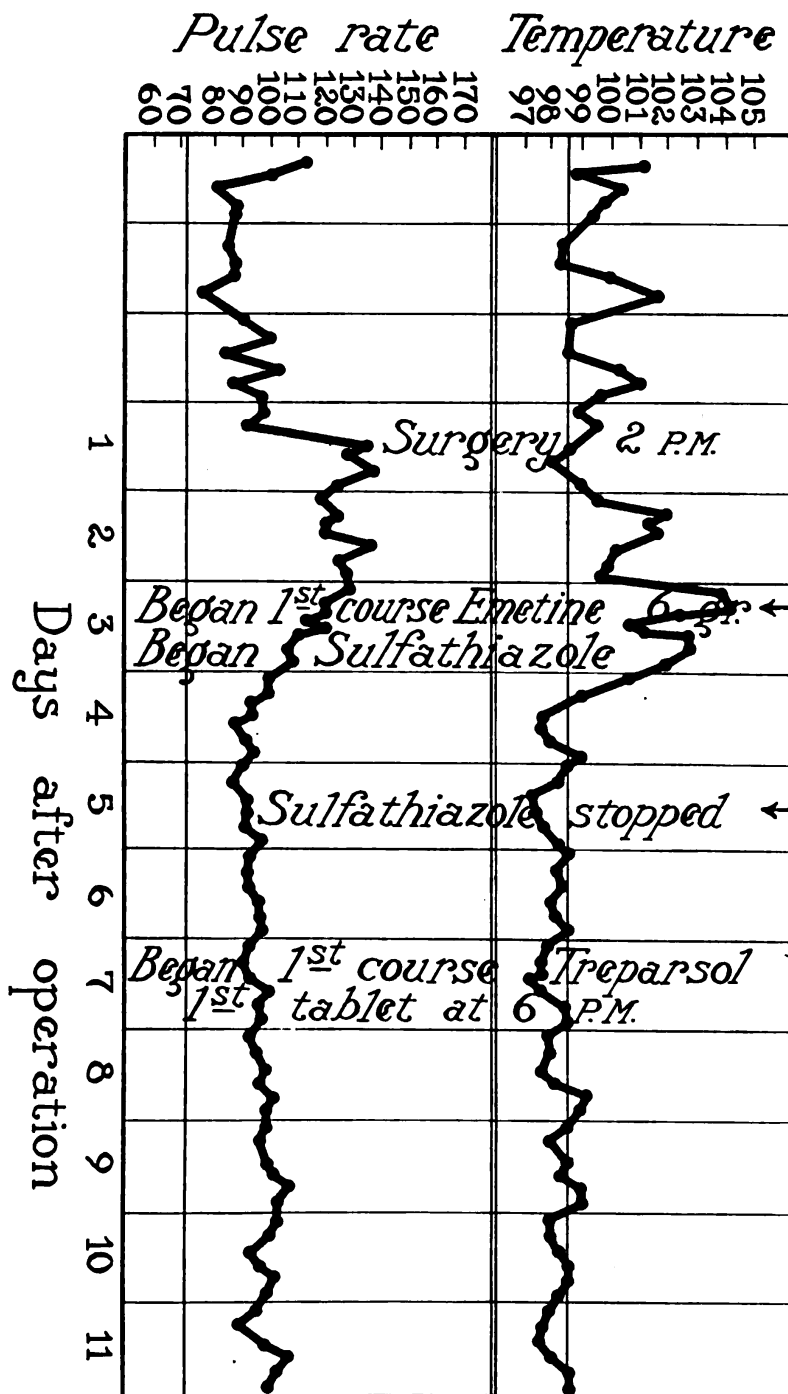
Figure 1.—Temperature chart. Patient's temperature rose sharply to 104° F. on third postoperative day but decreased rapidly after administration of emetine hydrochloride.

Three weeks after surgical operation, because of the apparent response of the patient to emetine hydrochloride, the appendix was examined by one of us (T. B. M.) who, using a special staining process, found many Endamoeba histolytica in the wall of the appendix.
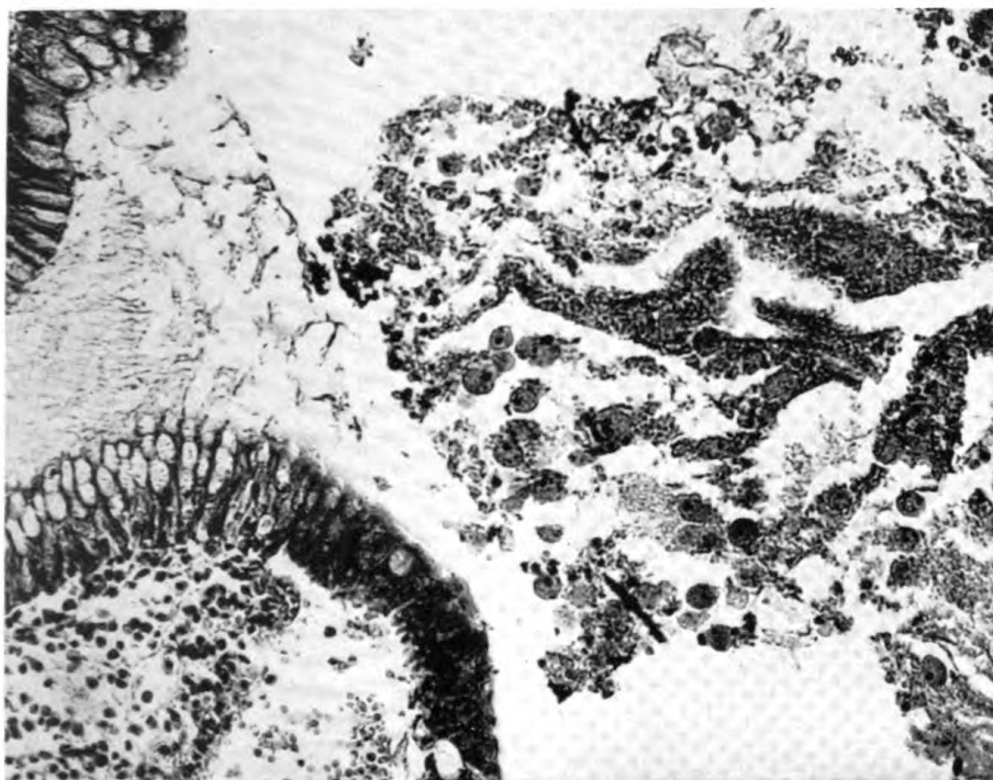
FIGURE 2.—TISSUE FROM APPENDIX REVEALING AMEBIC ULCER WITH PSEUDO-
MEMBRANE.
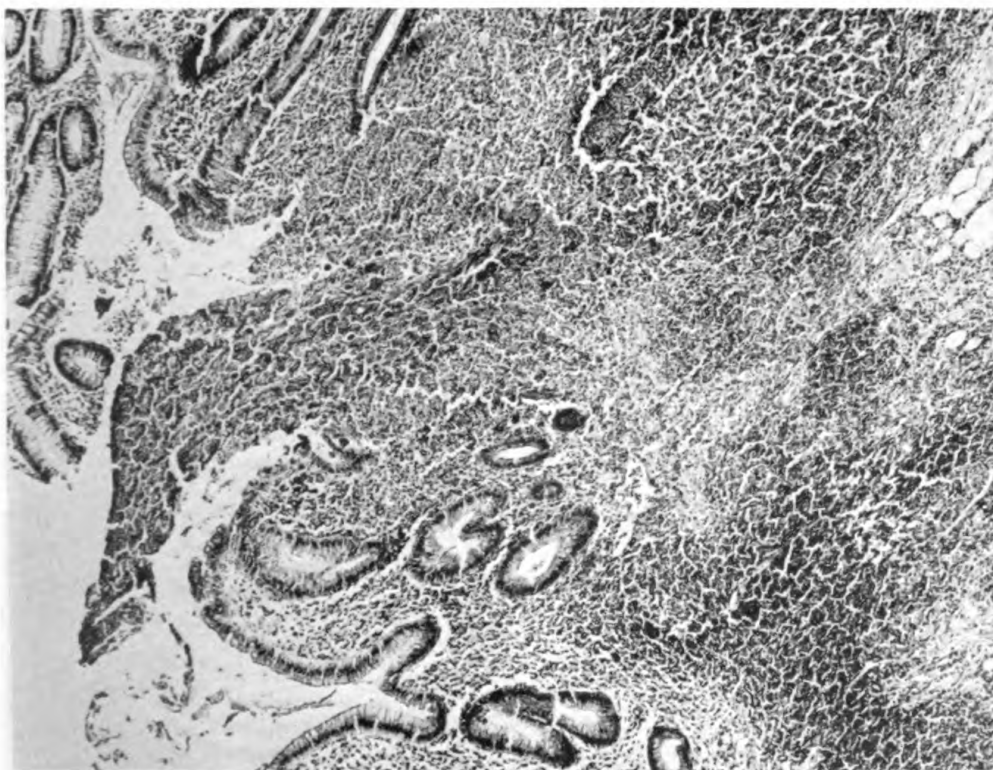
FIGURE 3.—EDGE OF THE PSEUDOMEMBRANE CONTAINING AMEBAS (HIGH POWER
MAGNIFICATION).

Four weeks after operation the patient was dismissed from our care. The liver was still markedly enlarged and the thoracic findings were still present both clinically and on roentgenographic study. However, with the exception of anorexia and weakness, she had no complaints. At the time of dismissal, the patient was advised to take a third course of 4 grains (0.26 gm.) of emetine hydrochloride and a third course of treparsol in 3 weeks.

The patient returned to the clinic June 9, 1940. One week prior to admission she had had an attack of intermittent vomiting, abdominal distention, and mild abdominal pain which lasted for 24 hours. During that time defecation had not occurred. Her condition in general had improved and the day after admission the symptoms disappeared. At this visit the edge of the liver was palpable at the border of the right costal margin. The thoracic findings which had concerned us during her severe illness had disappeared. Since that time she has had no complaints.

COMMENT

This case serves as an interesting example of diagnosis of amebiasis in the absence of those symptoms and findings which are usually considered significant in directing attention to this condition. It also illustrates an incidence in which specific treatment was instituted and favorable results obtained before the causative organism was found. Amebic abscess of the liver is a well-known entity, but in this instance there was no evidence of an abscess in the liver. On the other hand, for many years clinicians have considered the possibility of amebic hepatitis, a condition first predicated by Rogers.

The opportunity to determine the pathologic picture of amebic hepatitis was not made available to us in this instance as tissue was not taken from the liver. Considerable doubt remains, therefore, as to the exact nature of the lesion of the liver in this case. Whether it was due to the presence of amebas in the tissue or to some toxin caused by the lesions found in the appendix and some that may have been present in the cecum must remain unknown.

The failure to find amebas in the stools is of significance, because it is in keeping with what is generally known to parasitologists, namely, that not every specimen of stool from persons infected with Endamoeba histolytica contains amebas and although the parasites may be present, they are not always seen. In this instance only two stools were examined. These stools were passed normally and without catharsis. Therefore, the possibility of finding amebas in the stools was greatly lessened.

The frequency of involvement of the appendix in cases of amebiasis should be given more serious thought than it has received in the past. Harris, in 1898, probably was the first to give an accurate pathologic description of amebic appendicitis. He described the appendix as "much enlarged" and this same phrase has been used by almost every observer since. The same type of expression was used by the surgeon (Harrington) when he observed a "very marked

periappendicitis." Rogers stated that the appendix was frequently attacked by amebas and James, Clark, and others have called attention to the invasion of this organ by these protozoa. Clark observed that in 60 percent of cases of this type in which necropsy was performed amebic ulcers were found in the colon, whereas in 40 percent there were lesions in the dependent part of the colon and appendix. In 76 cases of ulcerated amebiasis, the appendix was found perforated by the abscess in 9.2 percent of the cases.

Amebic appendicitis cannot be diagnosed clinically. The only possible diagnosis is by laboratory examination, which can take the form of either one of two methods. First, examination of scrapings from the mucosa of the appendix and second, sectioning and staining the appendix. Since most pathologic material is placed directly in formalin it is not an easy matter to prepare adequate sections. However, by using the method described by Meriweather, which is a modification of the Best stain, these organisms can be demonstrated readily in material preserved in formalin. Another method is to refix the material in corrosive sublimate, acetic acid mixture, and then to make iron hematoxylin stains. In any event, if material of this kind is sectioned, reasonably large series of sections should be examined. Some sections cut from the appendix of this patient revealed no amebas at all and others disclosed the presence of many Endamoeba histolytica (figs. 2 and 3).

In view of the fatalities that resulted from the performance of appendectomies on persons suffering from amebiasis contracted in Chicago in 1933, it is not unreasonable to suppose that in any long series of appendectomies death of some patients following operation can be explained on the basis of amebic infections of the appendix. It may be concluded with some justification if this patient had not received adequate antiamebic treatment, the outcome of this operation may have been fatal.

The probable origin of amebiasis in this case is also an interesting subject for speculation. The patient has lived in Iowa since 1930 and has made several business trips to different parts of the United States. She made several trips to Chicago in 1933 and always stayed at one of the hotels involved in the epidemic. She is certain that she stayed in the hotel in July, the period in which the largest number of persons became infected. Some time thereafter, as far as she can recall, she had two attacks of diarrhea but never noticed either pus or blood in her stools. She cannot remember having had an attack of diarrhea prior to this time. During the attacks she had considerable trouble from cramps and it seems not unlikely that she acquired amebiasis at this hotel.

Although the opportunity presented itself, if it had been recognized, it is impossible to know whether the liver was enlarged because

of the presence of Endamoeba histolytica within its substance or not. The conclusion, however, seems to be justified that treatment by administrations of emetine hydrochloride and treparsol resulted in return of the liver to normal size; whether this was a direct or indirect effect of the drugs cannot be stated.

MALIGNANT GRANULOCYTOPENIA FOLLOWING SULFAPYRIDINE THERAPY

A CASE REPORT

By Lieutenant, junior grade, Martin Edward Conti, Medical Corps, United States Navy

Since the introduction of chemotherapy for gonococcal infections by Dees and Colston in 1937, there have been many reports in the literature concerning the complications and reactions arising from the use of the sulfonamides and their derivatives. Among these reactions may be mentioned the following: chills, rise in temperature, skin rashes of all types and severity, cyanosis, nausea, vomiting, headaches, neuritis, and depression of the bone marrow, resulting in agranulocytosis and anemias of variable severity.

Within the past year or so the trend of therapy has deviated towards the use of the more recent of these derivatives, namely, sulfapyridine and sulfathiazole. At the present time, practically all cases of gonorrheal infections in the male are being treated by one of these drugs instead of the earlier drug, sulfanilamide.

The advocates of sulfapyridine therapy in the treatment of the infections of gonococcal origin have submitted many reports in the literature to substantiate their claims of superiority over the earlier drug sulfanilamide. They claim a higher percentage of cures. However, other observers have shown that despite the greater efficacy of sulfapyridine therapy, this drug has a tendency to produce a higher percentage of reactions while other writers claim a less percentage of reactions; this is a disputed point. Fortunately, however, the majority of reactions noted by the use of sulfapyridine and its allied related drugs are of a nonfatal and transient nature. Occasionally, fatal reactions, such as severe agranulocytosis and hemolytic anemias, do occur following the use of these drugs and it is with this thought in mind that close supervision of all patients under this type of therapy is absolutely essential.

Sulfapyridine should only be administered under very rigid observation by a medical officer, who should always be on the alert for the early presence of any complication or reaction following its use. Upon the earliest signs of any of the above-mentioned reactions, the use of the drug should be discontinued immediately and other appropriate treatment substituted. This drug, even in doses smaller than advo-

cated by most observers, may be the cause of a fatal reaction, such as a severe leucopenia, anemia, or deposit of crystals in the urinary tract, resulting in.blockage of urinary flow with a resultant uremia.

Due to the widespread and almost universal use of the drug sulfapyridine throughout the service in the treatment of gonococcal infections, and that rarely, a patient may develop a serious, fatal reaction following its administration and after a period of latency, the following case report is being submitted as a reminder to us all that this drug is at times one of great toxicity. This toxicity may even be of sufficient degree as to cause death.

CASE REPORT

H. E. P., age 34 years, was readmitted to the hospital with the diagnosis of acute catarrhal fever on November 2, 1940. He complained of headache, malaise, slight soreness of his throat, and fever of 3-day duration. The family history and past history were irrelevant.

Present illness.—The patient developed an urethral discharge on October 10, 1940 at which time he was treated for nonvenereal urethritis by the use of sulfapyridine. Dosage consisted of 67½ grains daily for a period of 6 days, the patient having received a total of 405 grains of the drug. At the end of this course of therapy he was discharged to duty and remained well until 3 days prior to admission here, when he began to notice presence of fever being associated with generalized aching of the bones and some headache. Bowels were constipated. The fever persisted and gradually became more marked. The day previous to admission, he noted some soreness in his throat and also a slight, dry, unproductive cough. At this time he also seemed to suffer from excessive perspiration. The night prior to admission, the patient had a chill. The following morning, he reported to the sick bay, where he was examined and then transferred to the hospital for further treatment.

Physical examination.—T. 103.4; P. 90; R. 18; B. P. 92/70. The patient is a well developed and well nourished white male, acutely ill, with some flushing of face and marked perspiration, cooperative but complaining of generalized aching of body and headaches. The skin is moist and very hot. The eyes show moderate injection of the conjunctiva. Pupils regular and equal and react to light and accommodation. External ocular movements normal. No nystagmus or jaundice. The ears and nose, normal. Tongue coated, throat mildly reddened and injected. No evidence of any edema. Thyroid normal. There were a few palpable lymph glands in the right cervical triangle. Heart, normal size. Sounds regular, clear, and good tone. Aortic second slightly accentuated. No murmurs. Lungs, tactile fremitus, percussion, and auscultation normal. No rubs or rales. Bases descend well and equally. Abdomen, normal contour. No masses, tenderness, or rigidity. The liver, spleen and kidneys are not palpable. Genitalia, no urethral discharge or abnormalities. Reflexes, active and equal. No clonus, Babinski neg.

Impression: (1) Agranulocytosis following use of sulfapyridine; (2) Influenza.

Upon admission and throughout the period of illness, numerous blood counts were taken which are shown in Table I. Upon admission there was a slight basic strippling of the red blood cells. The blood sulfapyridine was negative. Upon the recommendation of the roentgenologist, the patient was given a stimulating dose of roentgen ray over the long bones. This was followed by an

intramuscular injection of 10 cc. of pentnucleotide. He was immediately typed and given 450 cc. of citrated blood at 4 p. m., 6 hours after admission, and another intramuscular injection of 10 cc. of pentnucleotide. Another blood count was taken at 8 p. m. The patient appeared less toxic and stated that he felt much better. Temperature at this time was 102; P. 86; R. 22. He was taking fluids by mouth nicely and was fairly comfortable.

On the following morning, November 3, 1940, the patient appeared to be improved clinically with the exception that he now complained of a more marked soreness of his throat than on admission. Reexamination of the pharynx showed some edema of the right tonsillar fossa and uvula and an increase in redness noted. The lymph glands in the neck were slightly more tender to palpation. The patient was seen in consultation with the otolaryngologist who advised hot gargles and continuation of the former therapy. T. 103; P. 90; R. 20. A white blood count was taken and the patient was given 10 cc. of pentnucleotide intramusclarly and at 11 a. m. given another citrated blood transfusion of 400 c. of whole blood without reaction. His condition remained about the same and at 4 p. m. another count was made. There was little variation in the temperature, pulse and respiration. The throat smear was negative for streptococci, Klebs-Loeffler bacilli and Vincents infection. Urinalysis showed 20 mgms. albumin. He spent a fairly comfortable night and slept at long intervals. The patient was taking an adequate amount of fluids (3,000 cc. in 24 hours) by mouth without difficulty.

On November 4 the blood count at 8 a. m. had not improved, but despite this fact the patient stated that he felt better and he appeared brighter than on admission. T. 102.6; P. 94; R. 20. The increase in the monocytic count was a source of some encouragement and hope that the bone marrow was now beginning to show some evidence of stimulation from the pentnucleotide and blood transfusions. He was again given 10 cc. of pentnucleotide and at 11 a. m. given another citrated blood transfusion of 300 cc. of whole blood without reaction. At 4 p. m., despite the hope offered by the increased monocytes, the patient seemed worse clinically as manifested by a rise in temperature. T. 103.8; P. 106; R. 244. He continued to become worse and for the first time to refuse fluids, thus necessitating an intravenous injection of 1,000 cc. of 10 percent glucose in the evening.

On morning of November 5, 1940, the patient continued to remain toxic and became more restless. At this time he commenced to have a slight cough and complained of some discomfort in his chest. Examination of the chest revealed some diminution of percussion note and an increase in breath sounds over the right upper lobe anteriorly and also posteriorly. No rales were audible. Impression was that he was beginning to contract an early consolidation over this area. X-ray of the chest confirmed the clinical findings and in adition revealed some congestion throughout remainder of the lung fields. Examination of sputum obtained was negative for pneumococci or streptococci. He was given 10 cc. of pentnucleotide followed shortly by another blood transfusion of 350 cc. of citrated blood. At 1:30 p. m. his condition became worse and there was an increase in the temperature and pulse so he was placed in an oxygen tent. At 4:30 p. m., another blood count was taken and despite the apparent effort of the hemapoietic system to bring forth new blood cells to combat the toxicity, the patient's condition remained critical and very little hope was now held for a favorable prognosis. At 8 p. m. he continued to become worse steadily despite all forms of cardio-respiratory stimulants, intravenous fluids, and continuous administration of oxygen, etc. His condition became precarious during the night with the development of increased, labored respirations, rise in pulse rate, and appearance of cyanosis of the lips and nail beds of fingers.

He survived the night and on the morning of November 6, 1940, 4 days after admission to the ward, he expired at 9:15 a. m. A blood count was taken just before his death.

Unfortunately, a postmortem examination was not obtained so that the pathological studies, which undoubtedly would have been of very marked interest, especially those of the bone marrow, were not available.

TABLE No. 1

Date	Hour	Hgb.	R. B. C.	W.B.C.	Differential	Treatment
Nov. 2, 1940	10 a. m.___	Per-cent 68	3, 280, 000	1, 900	Seg., 0%; lymph., 98%; mono., 2%.	20 cc. Pentnucleotide. 450 cc. blood trans-fusion.
	1 p.m.____	------	----------	1, 300	Seg., 0%; lymph., 99%; mono., 1%.	
	5 p. m.___	------	----------	1, 450	Seg., 8%; lumph., 91%; mono., 1%.	
	9 p. m.__	------	----------	1, 200	Seg., 7%; lymph., 90%; mono., 3%.	
Nov. 3, 1940	7 a. m.___	------	----------	1, 150	Seg., 4%; lymph., 95%; mono., 3%.	20 cc. Pentnucleotide. 450 cc. blood trans-fusion.
	4 p. m.___	------	----------	1, 100	Seg., 1%; lymph., 98%; mono., 1%.	
Nov. 4, 1940	8 a. m.___	78	4, 170, 000	1, 300	Seg., 0%; lymph., 84%; mono., 16%.	Pentnucleotide 20 cc. 300 cc. blood trans-fusion.[1]
	4 p. m.___	------	----------	1, 350	Seg., 1%; lymph., 66%; mono., 33%.	
Nov. 5, 1940	8 a. m.___	78	3, 700, 000	1, 350	Seg., 0%; lymph., 78%; mono., 22%.	Pentnucleotide 20 cc. 400 cc. blood trans-fusion. 1,000 cc. 10 percent glucose.[2]
	4 p. m.___	------	----------	6, 550	Seg., 2%; lymph., 73%; mono., 25%.	
	8 p. m.___	------	----------	2, 550	Seg., 2%; lymph., 52%; mono., 40%. Bands, 1%; Juv., 1%; Myel, 4%.	
Nov. 6, 1940	8 a. m.___	------	----------	11, 600	Blast, 25%; pre-myel., 5%; myel., 20%; juv., 2%; band, 1%; lymph, 34%; mono., 13%.	1,000 cc. 10 percent glu-cose. Oxygen tent.

[1] Intravenous glucose 10 percent given also.
[2] Oxygen tent.

SUMMARY AND CONCLUSIONS

1. A case of severe, depressing effect of the hemapoietic system in a patient belonging to International Blood Group A, and resulting in a fatal, marked diminution of granulocytic cells following the administration of sulfapyridine is hereby presented in detail.

2. No other cause for the marked leucopenia could be demonstrated; despite the fact that there was a latent period of 2 weeks before the toxic effects of the drug manifested themselves, it is logical to assume that the sulfapyridine therapy was the underlying cause.

3. A report in one of the Fleet Medical News Letters calls attention to the fact that, for some as yet unknown reasons, it has been demonstrated that patients belonging to the blood group "A" seem to be more susceptible or sensitive to sulfapyridine than those patients of other blood groups.

4. With sulfapyridine being used extensively throughout the service, it may be noted that fatal reactions and complications arising

from chemotherapy with this drug may occur, as is shown and illustrated by this case report.

5. This case should be a reminder to all medical officers using sulfa-pyridine, to be on guard for any early complications or reactions arising from its use, and upon the earliest appearance of these reactions, the drug should be withdrawn immediately and other therapy instituted.

TRAUMATIC SUBARACHNOID HEMORRHAGE

A CASE REPORT

By Lieutenant, junior grade, T. Schlossbach, Medical Corps, United States Naval Reserve

In 1938 Irving J. Sands of Brooklyn reviewed a series of 83 cases of subarachnoid hemorrhage and classified them as those caused by (1) trauma, (2) arteriosclerotic degeneration of the vessel wall, (3) septic or infectious emboli in the vessel wall causing its destruction, (4) ruptured intracranial aneurysm, (5) intraventricular hemorrhage, (6) blood dyscrasias, (7) ruptured vascular neoplasm. He stated that subarachnoid hemorrhage is a symptom and not a disease entity. It is due to blood escaping into the subarachnoid space caused by any of the above factors.

He also stated that the term "traumatic subarachnoid hemorrhage" should be limited to that group of patients in whom there has been a trauma to the head causing an injury to the small pial vessels, and where there has not been an injury to the brain itself.

The following case illustrates the above type of injury due to trauma following a practice parachute jump.

CASE REPORT

On March 28, 1941, the patient made a practice parachute jump from the "fly-away tower" at Hightstown, N. J. This tower is 125 feet high, and holds an open parachute. The trainee suspended is actually 85 feet from the ground. On landing, he struck the back of his head with what he described as a "snapping motion." He was somewhat dazed, but did not lose consciousness. He was brought to the Naval Air Station Dispensary at Lakehurst, N. J., a distance of 30 miles.

The physical examination revealed a well-nourished marine, age 22, weight 147, who appeared somewhat dazed, but well oriented, and complained of a severe headache located deep in the occipital region. He had no nausea or vomiting. The blood pressure was 118/70 and the pulse, 74. There was no evidence of trauma or swelling of the scalp. No bleeding or discharge from the ears. The pupils of the eyes were regular, and reacted promptly to light and accommodation. No nystagmus. The fundi were normal. The pharyngeal reflex was normal but the tongue deviated slightly to the right. No rigidity of the neck, but had pain on motion, with moderate tenderness on deep pressure over the suboccipital region. The heart and lungs were normal. The superficial reflexes of the abdomen were absent; no masses or organs palpable.

Knee jerks were slightly hyperactive but equal. Babinski normal. The x-ray of skull was negative for fracture. Hemoglobin 95 percent; R. B. C. 4,850,000; W. B. C. 8,400. Kahn reaction negative.

A tentative diagnosis of sprain of the ligamentum nuchae was made and the patient hospitalized. The pain, however, persisted, always in the same location and was not relieved by codeine sulphate. A spinal tap was done on March 30, 1941. The spinal fluid was distinctly yellow-red in color, containing 560 red cells per cubic millimeter. The diagnosis of subarachnoid hemorrhage was then made because of the history of trauma, the presence of the severe, persistent occipital headache, the absence of definite localizing signs, and the finding of bloody spinal fluid.

The headache gradually disappeared following repeated spinal taps, a total of 6 being done. The number of red cells present in the spinal fluid gradually decreased. The last tap on May 7, 1941, was clear in color, and microscopic examination revealed no red cells. The patient remained in bed for 6 weeks and when discharged was free from all symptoms and signs. Recommendation was made that he be transferred from the parachute troops.

COMMENT

Most of the cases of subarachnoid hemorrhage have been classified as spontaneous, with the underlying pathological change being that of a ruptured aneurysm, usually congenital. This case seems to fit the classification given by Sands, limited to those due to trauma. It also illustrates the possibility of subarachnoid hemorrhage occurring from a moderate head injury, which could easily be overlooked. It also demonstrates the possibility of this type of injury which must be kept in mind in all head traumata especially with the present program of extensive parachute training.

REFERENCE

Tr. Am. Neurol. Assoc. 64: 144–151, 1938.

EFFECTS OF PREGNANCY ON CHRONIC ATROPHIC ARTHRITIS

A CASE REPORT

By Lieutenant Stephen E. Flynn, Medical Corps, United States Navy

Many of the ancient Greek physicians declared that increase and decrease of the lunar orb may represent the causes of increase or decrease of certain diseases in women, and especially regulating the menstrual cycle. Many recent writers have stated in the past that frequent child-bearing may be a factor in bringing on arthritis. Many writers insist that pregnancy is dangerous to arthritic women because the joints may flare up after parturition. Due to the brief amount of literature on effects of pregnancy on chronic atrophic arthritis, I wish to report complete relief of symptoms and pain in one case of atrophic arthritis following pregnancy.

A white woman, 28 years of age, complained of stiffness and soreness in hands and feet, which was first noticed in October 1933. Her feet were so painful and sore than she was unable to stand or walk for any length of time. This was 2 months after her second child was born. Patient was living in the desert when the first attack came on. The pain and soreness in the transverse arches and joints and toes subsided some during the third pregnancy, but returned again 3 months post-partum.

The arthritic condition remained about the same until 1936. After a trip of about 4,000 miles, her condition became worse with swelling of all joints in fingers, wrists, left elbow, right ankle and knee. She was unable to bear any weight on the right leg on account of pain in the knee and hip joint. Her condition became so acute that she had to resort to crutches and was unable to attend to her household tasks. She remained in this condition for 1 year.

Physical examination: General appearance, poorly nourished white female about 31 years of age. Appears to be toxic and in great discomfort. Facies appears drawn. Eyes react to light and accommodation. Nose and throat, normal; tonsils, out. Teeth, normal. Neck, grating sensation about the first and second cervical vertebrae. Thyroid, negative. Chest and lungs, negative. Heart, normal. Blood pressure, 120/75. Abdomen, old surgical scar, mid-line, otherwise normal. Both adnexa appear normal.

Extremities: There is a marked swelling of both hands and phalangeal joints with spindle-shaped deformities. Both wrist joints swollen. Thirty percent limit of motion in left elbow joint. There is tenderness on pressure and motion along the lumbar and sacral spine. There is a marked swelling and tenderness with 50 percent loss of motion in the right ankle joint. There is tenderness and soreness in transverse arches of both feet. Patient is unable to bear her own weight on right leg.

X-ray findings: The left elbow as compared with the right shows slight haziness and loss of lime salt content of the bones and slight decrease in the joint-space. There is no evidence of roughening or irregularity of the articular surfaces. The right knee shows only slight general haziness. There are changes similar to those in the elbow involving the third digit of both hands and the fifth digit of the left hand at the proximal interphalangeal joint. There is a slight degree of lime salt deficiency of all bones visualized. There is marked soft tissue swelling of the right knee, of the third digit both hands, and of the fifth digit, left hand, giving a spindle-shaped deformity.

X-ray of chest, negative. Gall bladder and gastrointestinal series, essentially negative. Basal metabolism rate, plus four.

Electrocardiogram report—Graphic impression: (1) Premature contractions, ventricular, occasional. (2) Sinus tachycardia.

Laboratory reports: The sedimentation time, 27 millimeters in 60 minutes. Bunnell, heterophile agglutination positive to serum dilution 1–32. Blood culture, negative. Sterile urine for culture: Culture shows a growth of staphylococcus albus. No other organism found. Urinalysis: Appearance, clear; reaction, acid; specific gravity, 1.008; albumin, negative; sugar, negative; leucoytes, few; epithelium, many squamous. The blood chemistry revealed a uric acid of 2.6, a calcium of 11.86, and a phosphorous of 2.245 milligrams. The feces examination was negative for ova and parasites. Occult blood positive, one plus. Hemoglobin 65 percent, Talquist. The red-blood count was 3,950,000; the white-blood count, 10,500. The differential count showed 17 band forms and 53 segmented neutrophiles, 25 lymphocytes, and 4 monocytes. The blood Kahn was negative.

Summary of treatment before pregnancy is as follows:

1. Many kinds of vaccine were tried with little or no relief.
2. Diathermy for 1 year with relief only while patient was under machine.

3. Therapeutic fever in which the temperature was elevated to 104° F. over an 8-hour period. This treatment was given twice within a week's period, and due to its weakening effect, was discontinued.

4. Intramuscular injections of colloidal gold were tried with no relief.

5. Whirlpool baths of magnesium sulfate were given daily for a period of over 6 months. The patient's body was submerged in water and the temperature gradually increased from day to day until a maximum of 120° F. for 15 minutes was reached. During the whirlpool bath, massage and active and passive motion were applied to the affected joints.

6. An infrared lamp was used by the patient at home daily on the joints most affected.

7. Prontosil, 15 grains every 4 hours, was given until her condition became worse with this drug and it was discontinued.

8. Aspirin was found to be the most suitable drug in relieving pain and joint soreness.

9. Large doses (10,000 units) of vitamin D in the form of drisdol were given daily over a limited period of time with no noticeable improvement. This was discontinued and normal doses of vitamin D given together with vitamin B-1 in the form of betaxin during the entire course of the disease. Liver extract was given intramuscularly whenever the erythrocytes or hemoglobin fell below normal. A well-balanced nutritious diet was carried out during the entire period. Insulin was given for a time in an effort to stimulate metabolism and increase weight.

The age-old treatment of hydrotherapy with magnesium sulfate was the most beneficial in reducing the stiffness of the joints and in the relief of pain.

The patient became pregnant in April 1938, and at that time pain and symptoms gradually decreased until by the time she was 4 months' pregnant, all articular symptoms had subsided. On January 19, 1939, the patient delivered a normal 7½-pound baby boy. Patient enjoyed good health without the aid of pregnancy for 15 months until on March 30 she became pregnant again and had an uneventful pregnancy. On December 29, 1940, she delivered a vital 7½-pound boy. Six weeks after this delivery the arthritis returned with the same severity that she had experienced 3 years ago, and at the present time, she can carry on very limited household duties.

CONCLUSION

I have pointed out that climatic conditions (desert) were ideal when arthritis occurred, which is contrary to general opinion; and the extensive treatment carried out for 3 years before pregnancy had little effect on the disease. It is difficult to point out the agent responsible in pregnancy that clears up the arthritis, but one thing is certain—that is that pregnancy has great ameliorating effects on chronic atrophic arthritis, and it is unbelievable the recovery from pain and symptoms which these patients experience while pregnant. The relief sometimes lasts for many months after gestation. In those cases where focal infection has been eliminated and the arthritis still persists, large doses of vitamin D along with some of the sex hormones (female) should be tried, or transfusion of placental blood plasma may be a step forward in the treatment of this disease. Arthritis should be treated in the same manner as tuberculosis, where separate wards or hospitals are

established for the treatment of this disease alone, and the interest of the attending physician is not distracted by more encouraging medical cases.

INFECTIOUS MONONUCLEOSIS

A CASE REPORT

By Commander J. R. White, Medical Corps, United States Navy

A textbook defines infectious mononucleosis as an acute infectious and contagious disease, observed chiefly in children and young adults, occurring often in epidemics; characterized by malaise, fever, a peculiar type of pharyngitis and sometimes conjunctivitis, marked enlargement of the lymph nodes and spleen, and a striking alteration of the leukocyte formula, usually with leukocytosis (1).

The causative agent is not known, but a virus has been suspected. The manner of spread is not understood. Sporadic cases of the disease usually occur, but large epidemics may develop among individuals who are closely associated, as in schools and barracks.

Atypical forms of the disease may be encountered in which there are no clinical signs, the disease being discovered quite by accident during routine leukocyte counts. Such an epidemic (16 cases) has been reported from a children's sanatorium in Chicago (2).

The incubation period varies from 5 to 12 days. Prodromal symptoms are not uncommon and may consist of sore throat, headache, and malaise. The onset is usually abrupt, with chills, headache, and sore throat, prostration and fever. Pyrexia varies from 99 to 103° F., and may continue for 15 or more days, usually subsiding by lysis. Drowsiness is sometimes a striking symptom on the third or fourth day. Cervical glands are occasionally enlarged at the outset, but more often glandular enlargement is not pronounced until the fever has reached its height. The posterior cervical and submaxillary glands are most frequently affected, although the axillary and inguinal glands may be involved to a lesser degree. The spleen can usually be palpated at some time during the disease and rupture of this organ has been reported (3). Secondary infection of pharynx and tonsils occurs rather often and suppurative adenitis is a rare but serious complication, as septicemia has ensued (1).

Laboratory findings are characteristic and diagnostic. There is lymphocytosis (not monocytosis) and the lymphocytes are of all possible sizes, shapes, and staining characteristics. Great variability in the type of lymphocytes is the outstanding feature (4). The white count may exceed 35,000. There is at first a slight polymorphonuclear increase followed by a relative and actual neutropenia and a marked increase in the lymphocytes, which may reach as high as 95 percent of

the total white count. There is no anemia and no reduction of the blood platelets. The characteristic blood picture usually develops rapidly, although as much as 10 days may elapse before the picture is complete. The presence of heterophile agglutinins in the patient's blood for sheep cells is said to be of diagnostic value.

As the symptoms of this disease become more widely recognized it is evident that many cases have formerly been erroneously diagnosed as "grippe," influenza, septic sore throat, mesenteric adenitis, appendicitis, etc. By careful physical examination with particular emphasis on the enlargement of lymph nodes and spleen, and routine daily checking of the leukocyte formula until the characteristic blood picture has developed, the percentage of recognized cases should be greatly increased.

The prognosis is good. There is no special therapy for the disease other than symptomatic treatment and good nursing. The sulfonamide drugs are of no value unless there is secondary infection with streptococci or pneumococci (4).

CASE REPORT

An officer, 26 years of age, was admitted to the dispensary on March 26, 1941, with an undetermined diagnosis. The chief complaint was pain in the lower back and fever. Family and past histories were irrelevant.

About 24 hours before admission, he began to have pain in the lumber region, general malaise and fever. He had recently been somewhat constipated, but had felt well until the onset of the disease. On admission the temperature was 100, pulse 80, respiration 20.

The physical examination revealed a well developed and nourished individual in no great discomfort. The eyes, ears, and nose were normal. Tonsils enlarged but no evidence of acute infection. Pharynx slightly injected. Heart and lungs normal. Abdomen: No masses or tender areas. Spleen not palpable. Extremities normal. Neurological: Reflexes normal, no tremors. Glandular system: No adenopathy noted.

The laboratory findings showed the urinalysis to be normal and the results of the blood counts are shown in table I. A temporary diagnosis of acute catarrhal fever was made.

On March 31, 5 days after admission, the temperature fluctuated between 99 and 100° F. The patient complained of pain in the anterior cervical region and a sore throat. Examinations showed both anterior and posterior cervical glands enlarged and tender and the pharynx was deeply injected. On this date, another count was taken, the temperature still fluctuating and cervical glands remaining swollen and tender. On April 7, 12 days after admission, the spleen became palpable and the white blood count showed an increase with preponderance of lymphocytes. At this point the temperature began to drop by lysis and the adenopathy began to subside. On April 11, the icterus index was 4 units and the leucocytes increased to 24,600, with 86 percent lymphocytes, thus confirming a diagnosis of infectious mononucleosis.

Temperature returned to normal by lysis, glands and spleen subsided, and the leukocyte count gradually assumed a more normal formula. The patient returned

to duty on April 24, 1941, having been on the sick list 29 days. Treatment was entirely symptomatic.

The results of blood examinations are given in the following table:

TABLE I.—*Blood examination*

Date	Differential count								
	RBC	Hgb.	WBC	Bands.	Segs.	Lymphs.	Eos.	Basos.	Monos.
		Percent		*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Mar. 26..	4.9	98	5.4	28	18	46	2	1	5
31..			8.2	19	15	57	4	0	5
Apr. 1...			5.2	13	12	61	3	0	11
2...	4.6	94	10.0	18	6	64	1	0	11
3...			14.7	13	3	70	0	0	14
5...	4.7	94	16.7	5	4	88	1	0	2
7...	4.7	91	17.2	5	8	82	1	0	4
8...			16.1	9	3	86	2	0	0
10..			23.1	3	5	89	1	0	0
11..			24.6	5	6	86	0	0	3
13..			14.3	5	15	79	0	0	1
14..			10.4	8	10	76	0	0	6
17..			7.2	2	15	76	1	0	6
19..			6.8	11	11	72	0	0	6
22..			7.2	4	28	66	0	0	2
24..	4.8	91	11.4	1	27	70	0	0	2

SUMMARY

A brief résumé of the symptoms and laboratory findings of infectious mononucleosis, together with a case report, has been presented with a view of inviting attention to the fact that cases presenting symptoms usually associated with catarrhal fever should be carefully observed for infectious mononucleosis.

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ACUTE MYELITIS

SYNDROME OF OCCLUSION OF THE ANTERIOR SPINAL ARTERY AT THE FIRST THORACIC CORD SEGMENT WITH SOFTENING OF THE CORD

By Lieutenant Commander B. W. Hogan, Medical Corps, United States Navy

Complete or partial softening of one or more adjacent segments of the spinal cord, due to thrombosis of diseased arteries and veins, especially of the anterior spinal artery, and independent of trauma or of external pressure, has commonly been termed "acute myelitis."

The essential lesion, however, is rarely inflammatory but most commonly necrotic in origin.

The symptoms are those of paraplegia with the usual motor, sensory, and reflex disorders. The onset is usually sudden, sometimes supervening within a few hours.

A case of acute myelitis was recently admitted aboard the hospital ship. Although anatomic verification is lacking, there is little doubt as to the exact nature and location of the pathologic process, namely, occlusion of the anterior spinal artery at the first thoracic segment with softening of the anterior portion of the cord at and below this segment.

CASE REPORT

Complaint.—G. W. N., fire controlman second class, was admitted with a complaint of "weakness of hands and paralysis of lower extremities."

Onset.—Saturday evening, July 13, the patient experienced a dull, aching pain which radiated upward from the medial surface of the left elbow to and across the upper anterior chest wall. Pain kept him awake for 1 hour. He slept the remainder of the night and next morning felt fine. About 1 p. m. on the 14th of July, a similar pain was felt over the same area but it also radiated down the inner area of right arm to elbow. The arms ached and there was no strength in hands. He visited the sick bay where he was given a salty tasting medicine. He then returned to his bunk and fell asleep. On awakening at 5 p. m., 4 hours later, his body felt numb from the chest down. He was unable to move his legs and control of bladder and bowel functions had been lost.

Patient had previously been under medical care, January 1940, for an upper respiratory infection. Two weeks before admission he had been lightly struck on the back of the neck with a soft ball. There was no pain, swelling, or incapacity at that time. Several days previous to the onset he had a mild coryza and cough. No chills or fever.

Physical findings.—A well-developed and nourished young blond adult. Temperature, 100°. Pulse, 78. Respiration, 20. Blood pressure, 136/70. Skin was clear. Slight injection of pharyngeal lymphoid tissue. Heart and lungs were normal. Abdomen normal. Genitalia, a slight mucopurulent urethral discharge, nonvenereal.

RÉSUMÉ OF NEUROLOGICAL FINDINGS

1. *Motor.*—Marked weakness in hands and arms. Flaccid paralysis of intercostal and abdominal muscles and muscles of lower extremities. Diaphragmatic breathing.

Sphincters.—Unable to empty bladder or evacuate bowels.

2. *Reflexes.*—The biceps and triceps were present; right reflexes more active than the left. The patellar and achilles jerks were absent. The abdominal and cremasteric reflexes were absent. Babinski was negative. There was no ankle clonus.

3. *Sensory.*—There was loss of pin prick (pain) and temperature sensation below the second thoracic dermatome. There was blunting of light touch over the same area. The vibration sense and sense of position was present and acute.

4. Slight Horner's syndrome on right (paralysis of the cervical sympathetic, miosis, ptosis, and decrease sweating over right side of face).
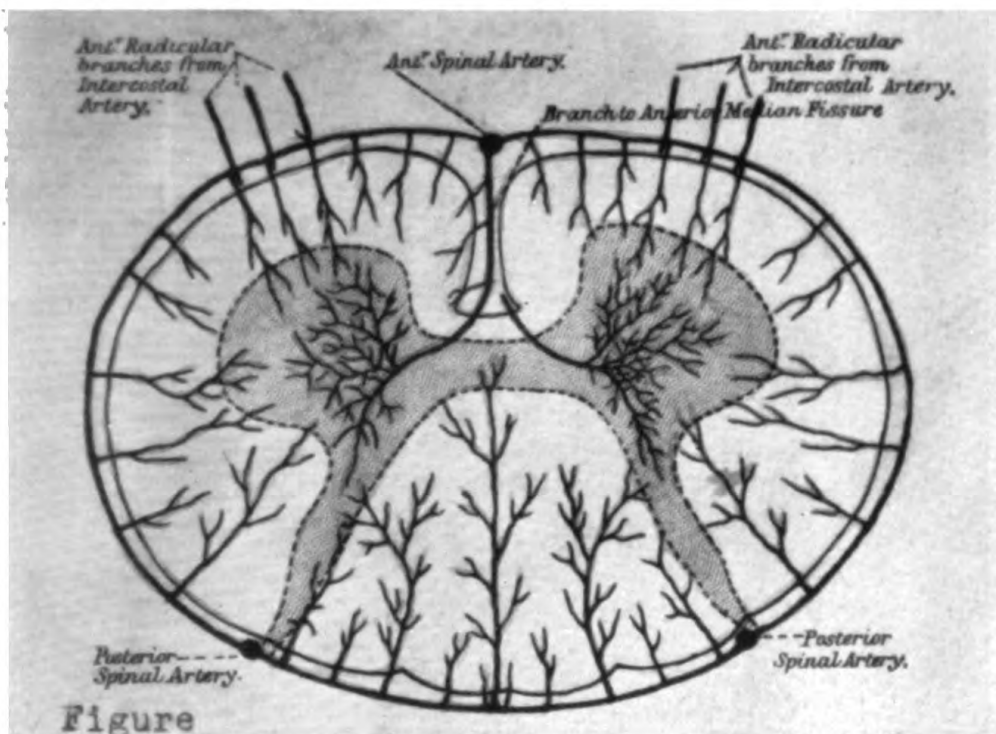
FIGURE I.—DIAGRAM OF THE COURSE AND DISTRIBUTION OF THE TERMINAL
ARTERIES OF THE SPINAL CORD.

(AFTER VAN GEHUCHTEN.)

The anterior spinal artery is formed by the union of the two arteries derived from each
vertebral artery; it may spring as a single branch from either the right or the left vertebral
artery. It descends along the anterior aspect of the cord in the anterior median fissure to
about the fourth or fifth cervical segment. Below this level, the anterior spinal artery
is formed by the union of the lateral spinal arteries. Its branches supply the gray matter
of the anterior horn, the commissural region and the base of the posterior horns. Throm-
bosis of the anterior spinal artery cuts off the blood supply to the gray matter of the
anterior part of the spinal cord and to the spino-thalamic, pyramidal and other tracts
situated in the anterolateral columns of white matter.

The two posterior spinal arteries are derived from the vertebral arteries. Below the level
of the fifth cervical segment they are formed by branches of the lateral spinal arteries.
They supplied the white matter and the posterior horns of gray matter. A peripheral
arterial anastomosis encircles the cord.

The lateral spinal arteries are branches of the subclavian artery, below the upper thoracic
cord they arise as branches of the intercostal arteries, the lumbar arteries, and the internal
iliac arteries. They form the anterior and posterior spinal arteries below the fourth or fifth
cervical segments.

The arrangement of the arterial vessels of the spinal cord is of clinical significance. The
richer supply of the gray matter by the central branches of the anterior spinal artery
accounts for the tendency of blood-borne infections to settle in this part of the cord.

The end branches of all the arteries entering the spinal cord are terminal. For this
reason embolism or thrombosis of an end branch is followed by softening.

5. Restricted forward neck bending. There was a soreness to pressure at the seventh cervical vertebra.

6. *Vasomotor changes.*—Cold and dry hands and feet.

Laboratory findings.—Complete blood count: Rbc. 4,590,000; Wbc. 7,400. Hgb, 84 percent. 4 Bands; 52 Segs; 33 Lymph; 3 Eosino; 7 Baso. Blood, Kahn negative. Urinalysis negative. Blood sedimentation rate 10 mm. per 60 minutes.

Spinal lumbar puncture, July 15, 1940. Clear fluid. Initial pressure 175 mm. of water. Rise on bilateral jugular compression 300 mm. of water. Quick fall to 180 mm. of water. Laboratory report on fluid showed: Cell count 3; Kahn negative; globulin, no increase; total proteins, 20 mbm. per 100 cc.; sugar, 53 mgm. per 100 cc.; chlorides, 814 mgm. per 100 cc.; gold curve, 0011100000.

Spinal puncture, July 16, 1940, repeated. Clear fluid. No evidence of block. Cells, 3; total proteins, 20 mgm. per 100 cc.; culture, no growth; gold curve, 0000000000.

X-ray of cervical vertebrae.—There is almost complete absence of the disk between C. No. 6 and C. No. 7, causing some hyperextension of the neck. The vertebrae are normal in appearance. There is also marked diminution in size of the right superior articular facet and total absence of the left superior articular facet of C. No. 7, causing rotary lateral curvature with the convexity of the curve to the right. There are no productive changes in the ligamentous attachments. While the above changes may be congenital in origin, they are also suggestive of a destructive process involving the disk and articular facets. The findings are not suggestive of an old traumatic process. Conclusion: (1) Congenital anomalies, (2) questionable destructive process, inflammatory or new growth.

Anatomic diagnosis.—A softening or myelitis of both anterior horns at the first, second, and third thoracic segments with involvement of the crossed fibers of pain, temperature, and light touch.

Pathological diagnosis.—A vascular disturbance of the anterior spinal artery, quite likely a thrombus. (See fig. 1.)

Course in hospital.—Patient was transferred to the U. S. Naval Hospital, Pearl Harbor, where a lipiodal injection failed to show any blockage in the spinal fluid pathways. There has been a return of some movement to the left leg. The right leg remains in a flaccid paralyzed state. There is a better hand grip but noticeable wasting of the interossei muscles bilaterally. The sphincter control is absent. The sensation of pain and temperature is now recognized above the level of the fifth thoracic segment. Vibration and position sense remain intact. Patient developed a pleuritic effusion at the right base.

SUMMARY AND CONCLUSIONS

A case of acute myelitis illustrating the syndrome of occlusion of the anterior spinal artery at the first thoracic segment and a figure showing the spinal cord tracts and blood supply is presented.

Extensive acute myelitis occurring in the upper thoracic cord segment produces a definite clinical picture of flaccid paralysis of hand muscles, trunk, and lower extremities. Later muscular atrophy. Loss of sphincter control. Loss of pain and temperature sensibility below the level of the lesion with the preservation of vibration sense and sense of position.

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PELVIRECTAL ABSCESS SIMULATING ACUTE APPENDICITIS

REPORT OF FIVE CASES [1]

By Lieutenant Commander Harry E. Bacon, United States Naval Reserve, and Theodore F. Reuther, M. D.

Pelvic abscess following acute appendicitis and salpingitis is frequently encountered, yet a suppurative process occurring infra- or subperitoneally is relatively rare (2). A search of the literature failed to reveal reports of cases of primary supralevator abscess simulating appendicitis, although during the past 6 years five such cases have come under our observation. Because of the symptoms, physical findings and original diagnoses, these cases are reported.

Case No. 1—R. G., a white female, aged 33, was seen in consultation February 25, 1938, because of anorectal discomfort. The patient stated that this pain, which had been present for 4 days, was deep seated, more or less constant, and not affected by movement of the bowels. The general history was irrelevant except that an appendectomy had been performed 4 years previously. Examination elicited a sphincter muscle of normal tone but a moderate degree of spasticity of the left levator was noted. High in the left pelvirectal fossa, an indurated mass was palpable. The temperature was normal. A provisional diagnosis of early pelvirectal abscess was made and hospitalization advised. This was refused. The following week she called at the office in great distress, the pain had recurred that morning with great intensity. Examination disclosed a large fluctuant mass seemingly high in the left pelvirectal fossa and more anterolaterally than was previously noted. The temperature was 99.2° F. Blood count: W. B. C. 15,000; polymorphonuclear leucocytes, 88 percent. Again hospitalization was refused. During the night, however, the patient vomited on three occasions. The pain, which was confined to the lower left quadrant of the abdomen, became unbearable and she was sent to the Temple University Hospital. On admission, a fluctuant mass, approximately the size of an orange was palpable in the left pelvirectal space. The rectovaginal septum as noted by both rectal and vaginal examination was the seat of a similar process of smaller size. The left lower abdominal quadrant was very tender and rigid. Peri-

toneal irritability was noted. Temperature 101.3° F., blood count: W. B. C. 22,000 polymorphonuclear leucocytes 94 percent, lymphocytes 5 percent, monocytes 1 percent. One gynecologist was of the opinion that the abcess was the result of some pelvic inflammatory process. Another concurred in this view and advised an immediate laparotomy. On the basis of the findings elicited by rectal examination, the left pelvirectal fossa was explored through an anteroposterior incision over the ischiorectal region; the levator fibers were then separated by hemostats. A large encysted fluctuant mass was felt at a high level, anterolaterally on the left and in the rectovaginal septum. The abcess was drained and gauze saturated with dichloramine-T inserted lightly into the cavity. As might be expected the temperature returned to normal and the abdominal pain subsided. The patient was discharged 7 days following operation. She progressed in an uneventful fashion. Subsequent check-up at the expiration of 6 and again at 12 months, found the patient symptom-free.

Case 2—E. F., a colored female, aged 22, was admitted to the Graduate Hospital September 2, 1937. She complained of pain in the right lower abdominal quadrant and in the rectum, the latter being accentuated by defecation. A provisional diagnosis of subacute appendicitis and ischiorectal abcess was made by the resident physician. The temperature was 99.2° F. The surgical resident did not seem alarmed nor was the case reported. An ice bag was placed on the abdomen in the interim. The following day the resident intern reported that the case had a well developed appendicitis with an indurated area to the right side of the rectum which caused extreme pain on palpation. Temperature 103° F., pulse 112, blood count: W. B. C. 15,000 polymorphonuclear leucocytes 90 percent. On examination a right ischiorectal, right pelvirectal and retrorectal abscess were found. The right lower quadrant of the abdomen was very tender and moderately rigid. Under nitrous oxide anesthesia, an incision was made in the skin over the right ischiorectal fossa and pus was found to flow freely. A large quantity of purulent material escaped on perforation of the right levator muscle. Further exploration showed the retrorectal fossa to be involved also. Within a few hours the appendiceal symptoms had subsided and the temperature returned to 99° F., pulse 88. The patient was permitted out of bed on the third day and hot sitz baths were begun. She was discharged from the hospital 2 days later and followed in the proctologic clinic. The wound healed satisfactorily and completely.

Case 3—L. P., a colored female, aged 26, was admitted to the St. Luke's and Children's Hospital in July 1934 because of acute pain in the abdomen. The patient stated that for 2 days she had experienced a sense of discomfort and weight in the pelvis. The pain, however, was cramp-like and she could not "straighten up." Several attacks of nausea were cited, no vomiting. Movement of the bowels had been regular and was not associated with pain. When seen, the patient appeared to be in agony; she was crying and lying on her right side with the knees flexed on the abdomen. On palpation of the abdomen, the tenderness was most marked immediately below McArthur's or McBurney's point. There was more than a suggestion of rigidity. Rectal examination showed a large fluctuant mass in the right pelvirectal fossa, the right levator and pyriformus muscles were spastic. Temperature was 101.3° F., pulse 110, respiration 22. Blood count: W. B. C. 26,000, P. 89 percent, L. 9 percent, M. 2 percent. A diagnosis of pelvirectal abscess with peritoneal irritation was made. Under spinal analgesia, employing 50 mg. of spinocaine, an anteroposterior incision was made in the skin over the right ischiorectal fossa. On perforating the levators, a large amount of purulent material escaped. The wound was enlarged and two cigarette drains introduced. The postoperative course was uneventful. She

was discharged from the hospital 5 days later and followed in the proctologic clinic. Patient was symptom-free when seen 8 months following operation.

Case 4, *C. S.*, a white female, aged 34, was admitted to Mercy Hospital in December 1934, with the diagnosis of acute appendicitis. The patient had complained of pain in the lower abdomen for 3 days and after taking epsom salts, she called her physician who then sent her into the hospital. A constant nausea but no vomiting was cited. As stated "when the bowels move there seems to be a peculiar sensation of a release of pressure." Defecation not only caused no pain, but relieved the abdominal tension. She was married, had one child and one miscarriage. Two years previously she had been treated for a vaginal discharge at another hospital; 1 year ago a left oophorectomy and curettage had been performed. Other history irrelevant. Abdominal examination showed some rigidity in the right lower quadrant with maximum tenderness over the region of the right ovary. The intern had felt a mass in the rectum, palpation of which caused the patient considerable distress. This mass was present in the right pelvirectal fossa and caused marked inward displacement of the rectal wall. The temperature was 102.2° F., pulse 118, respiration 24. The lungs were negative. Blood count: W. B. C. 32,000; P. 91 percent; L. 8 percent; E. 1 percent. A diagnosis of pelvirectal abscess was made. Under low spinal analgesia, employing 50 mg. of procaine, the customary anteroposterior incision over the ischiorectal fossa was made and carried through the levator immediately above in order to drain the right pelvirectal space. After evacuating the contents of the abscess cavity, cigarette drains wet with dichloramine-T were inserted loosely to the depth of the wound. The postoperative course was uneventful; the patient being confined to bed for 3 days, at which time the drains were removed. Hot sitz baths were ordered thrice daily thereafter and the patient discharged on the eighth postoperative day. The wound healed in an uneventful fashion. Neither complications nor sequellae ensued according to a letter from the patient received 4 months following discharge.

Case 5, *R. C.*, a white female, aged 27, had been admitted to the Graduate Hospital on August 17, 1933, and placed on the surgical service because of nausea, vomiting, and pain in the abdomen. The patient stated that she had been ill for nearly 2 weeks, and finally relinquished her position so she might rest at home. Medical attention gave no relief so she took a laxative of compound licorice powder. Diarrhea, vomiting, and tenesmus ensued. The past history was irrelevant except that it was customary for her to experience severe pain on the left side of the lower abdomen at the time of menstruation and not infrequently she was confined to bed at such time for 3, 4, or even 5 days. Temperature 102.3° F., pulse 120, respiration 24. Blood count: W. B. C. 22,500; P. 89 percent; L. 9 percent; M. 2 percent. Because of a palpable rectal mass, a proctologic consultation was requested. Rectal examination revealed a large fluctuant mass in the right pelvirectal space. The mucosa was tense yet movable. A narrow cord-like indurated mass was palpable behind the rectum. Examination of the abdomen elicited a slight degree of rigidity just to the right of the midline in the lower quadrant. The entire abdomen was tender but markedly so in this region. With a diagnosis of pelvirectal and retrorectal abscess with peritoneal irritability, 50 mg. of spinocaine were injected into the fourth lumbar interspace and the pelvirectal and retrorectal spaces explored through an anteroposterior incision to the right of the anal aperture. A large quantity of purulent material flowed freely from both spaces, especially from the pelvirectal. A stab wound incision was made over the left pelvirectal fossa from which a small amount of pus escaped. Gauze, saturated with dichloramine-T was introduced to the depths of the wound. The patient

had a stormy convalescence for the first week but was discharged from the hospital on the twelfth postoperative day. She was followed in the proctologic clinic almost daily for a period of thirty-odd days, when the wound was completely healed. This patient was last seen about 1 year ago and stated then that she had no complaints referable to the rectum.

The pararectal spaces are those spaces around the rectum (namely the pelvirectal and retrorectal) and are invested by the endopelvic fascia. Medially they are bound by a thin cellular layer and laterally by a thick fibrous layer. The pelvirectal spaces are two in number and are situated on either side and slightly to the anterior phase of the rectum. They are bounded posteriorly by the lateral ligaments or the rectal stalks of Jonesco (6) ; anteriorly in the male by the bladder, prostate, and seminal vesicles, and in the female by the broad ligaments and uterus; above by the reflected peritoneum; below by the upper or superior surface of the levator ani muscles, and medially by the rectum itself (1).

The peritoneum itself has no sensory innervation, these nerves lying in the connective tissue immediately below the true peritoneum (7). The anterior abdominal wall is supplied by sensory branches of the same nerves that supply the muscles. These are from a portion of the fifth and all the lower six thoracic nerves. The connective tissue below the pelvic peritoneum, however, receives its innervation from the fourth and fifth lumbar and the sacral nerves (5). This area of the peritoneum as well as the central and inferior portion of the posterior abdominal wall is less sensitive than that of the remainder. Cope (4) has clinically divided the peritoneum into demonstrative and nondemonstrative areas, the pelvic peritoneum being classed as nondemonstrative. It is for this reason that infections involving this area do not immediately produce lower abdominal pain, tenderness, or muscle rigidity.

The connective tissue beneath the pelvic parietal peritoneum is loose and areolar. Infections occurring therein can spread by way of the lymphatics or by direct extension into the loose tissue spaces. The mode of spread has been shown graphically by Hellier (7) who injected plaster of Paris into the area through the broad ligaments and compared it with the findings in cases of pelvic cellulitis of puerperal origin. He was able to show that spread from the pelvis occurs anteriorly and upward toward the inguinal ligament to involve finally the abdominal wall in this area. Pelvirectal abscesses occur in the same region and as they increase in size, may extend upward in the same manner. Involvement of the retroperitoneal connective tissue of the lower abdominal wall will produce pain, tenderness, and muscle rigidity. It is in this stage of the process that such symptoms are produced which may be interpreted as, or confused with, acute appendicitis.

SUMMARY

Five cases of pelvirectal abscess with symptoms simulating peritoneal irritation are reported.

The anatomy of the supralevator space is described and the mechanism of the symptoms produced discussed.

These cases indicate advisability of rectal examination in all cases of apparent appendicitis. Findings will ofttimes alter the diagnosis and may prevent an unnecessary laparotomy.

Immediate incision and drainage by the extrarectal approach should be performed so soon as diagnosis is made.

NOTE

Since this paper was submitted for publication, two additional cases have been observed.

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MEDICAL AND SURGICAL DEVICES

VISUAL ACUITY AND SPEED OF RECOGNITION

PRELIMINARY REPORT

By Lieutenant Commander L. D. Carson, Medical Corps, United States Navy
Comment by Commander E. C. Ebert, Medical Corps, United States Navy [1]

Recognizing certain limitations inherent in routine methods of testing visual acuity using standard test letters and test charts and being desirous of securing certain data relative to the speed of visual recognition, a machine has been devised using suggestions offered by Commander E. C. Ebert, Medical Corps, and some ideas of the writer for testing visual acuity in the following manner.

The machine devised was manufactured in the shops of the United States Naval Air Station, San Diego, California, and consists essentially of: horizontal and circumferential lines of standard sizes of test letters on a rotating drum or cylinder, so arranged within a black metal case with a small aperture that the desired size of test letters may be exposed singly before the aperture, timed as to length of exposure by varying the speed of rotation of the cylinder as well as the length of exposure of a plane shutter actuated by a variable cam. Photograph of the interior of this device is seen in figure 1.

The driving mechanism of the rotating drum is so designed that rotation of the drum is arrested during the timed exposure of each letter. The exposure time of each letter can be varied between ½ to 1 second by rheostat control of the motor.

Further control of the timed exposure of each letter is provided for by a plane shutter which is synchronized with the period of exposure of the letter on the drum. The shutter speeds can be varied between 1/50 second up to 1 second by means of a variable cam under the control of the operator of the machine.

After each letter exposure, a blank space on the drum is rotated before the aperture in the same manner. This interruption is to give the examinee sufficient time to name the letter.

PROCEDURE

Over 600 officers and aviation pilots who appeared for annual flight physical examinations at the United States Naval Air Station, San Diego, Calif., were tested under the following conditions by the writer.

First, each one was tested for visual acuity using the Green test cabinet. This was done for each eye. Following this, he was tested monocularly before the experimental machine, using the size type which had been read on the test cabinet, and decreasing the time of exposure of each letter until errors or failure to read were manifest.

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[1] Deceased.

These findings were recorded and the two comparative tests were recorded. A list of all cases examined with a summary of the four groups, is shown in the following table.

Speed of vision made in 617 cases

Class No. 1 visual acuity—20/15—210 eyes

	Eyes	Time Totals	Average speed of vision (seconds)
VOD	98	10.557	0.108
VOS	112	13.605	.121
VOD and VOS	210	24.162	.115

Class No. 2 visual acuity—20/20 plus—657 eyes

	Eyes	Time Totals	Average speed of vision (seconds)
VOD	332	55.015	0.166
VOS	325	43.121	.133
VOD and VOS	657	98.136	.149

Class No. 3, visual acuity—20/20—310 eyes

	Eyes	Time Totals	Average speed of vision (seconds)
VOD	159	40.756	0.256
VOS	151	40.796	.270
VOD and VOS	310	81.552	.263

Class No. 4 visual acuity—20/20 minus—55 eyes

	Eyes	Time Totals	Average speed of vision (seconds)
VOD	28	10.806	0.386
VOS	27	9.349	.346
VOD and VOS	55	20.155	.366

DISCUSSION

A reference to the recapitulation of the speeds of recognition shows within certain rather broad limits a definite relationship between the general level of visual acuity using the Navy standard illuminated Snellen's test types, and the speeds of recognition of similar sized types exposed before the timed aperture.

Another apparent finding is that in cases ordinarily classed as "20/20 with difficulty" or merely as "20/20 with delay," it was found that speed of recognition was either very slow or impossible to attain unless the next larger Snellen test type were exposed on the machine; which leads one to the conclusion that in such cases the better classification on the standard Navy test chart should be 15/20 or 20/30.

On the other hand, certain discrepancies occurring throughout the series demand an explanation. It was noted that in some cases when the individual could read better than 20/20 or even 20/15 on standard test charts, yet in developing his speed of recognition by the experimental machine he was unable to read 20/20 size type consistently at any of the speed ranges on the machine which ran as low as 1.0 second
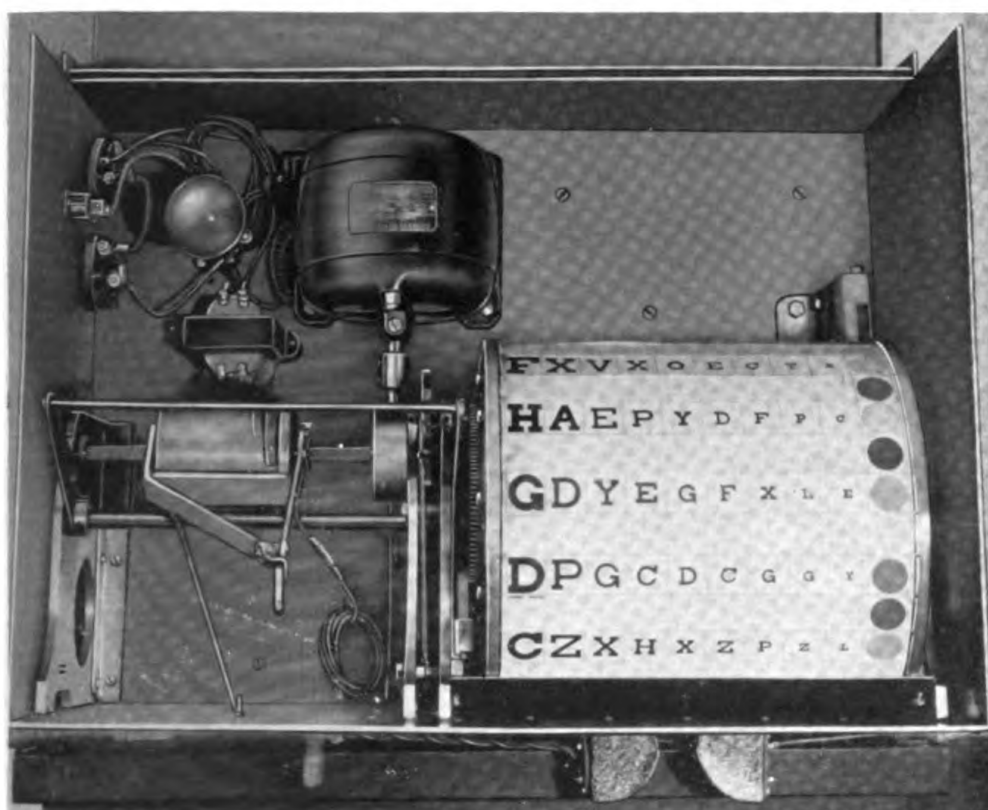
Figure 1.—Showing Interior of Device for Measuring Speed of Visual
Recognition.

exposure per letter, and in some cases required a 15/20 or even 10/20 size letter to attain even mediocre speeds of recognition. It is felt that in such cases the fault lies back of the eye, probably in the association pathways beyond the optic radiation or in some interference or blocking of motor-speech coordination.

It might be thought that light-dark adaptation of the eye would be a confusing factor. However, throughout these tests, whenever such discrepancies occurred, the test was run first in a totally darkened room with only the test letter illuminated, then with the room fairly well lighted by two overhead diffuse lights without glare in order to maintain the eye in a state of light accommodation. These two comparative conditions for the test run on the machine, however, were found to exert but little influence upon the ultimate speed of recognition attained by the individual being tested.

In a few cases the individual tested would readily read the 20/20 standard test letters, but would show an abnormally low speed of recognition. Just how to account for this variation requires consideration of several possibilities such as:

1. Imperfect retinal image due to latent refractive errors.

2. Imperfect retinal receptivity due to anomalies of the receptor mechanism as in faulty light-dark adaptation, partially at least a function of the retinal receptors.

3. Delay of the impulse in reaching the visual centers of the occipital cortex via the optic tract.

4. Slow reaction time—visual—motor-speech coordination, characteristic of certain individuals with typically deliberate habit pattern, and evidenced by stammering during the test as speed of machine increases.

Any one of the above factors could cause delay or inhibition in the speed of recognition of the test letters, and could well be made the subject of further investigation, and a more detailed study of this sort should very properly give due consideration to all such possible factors.

It is believed that this series of tests has warranted the following conclusions: 1, there is a definite relationship between findings of visual acuity using standard Snellen's test charts and speed of visual recognition; 2, that not every person able to read 20/20 test type or letter is capable of average speed of recognition; 3, that some individuals with imperfect visual acuity or below normal visual acuity are still capable of high speed of recognition when tested by type sizes which are easily visible; 4, that a certain low percentage of those tested show an abnormally delayed speed of visual recognition due to generally delayed reaction time, strong inhibitory psychic influences, imperfect retinal reception or high latent refractive errors, any one of which factors will have to be considered in any advanced study of this nature.

for medical officers to utilize all available space in the sick bay country to good advantage, so that the Medical Department can efficiently handle the increased work. Sick call must be held in such a manner that each patient is given thorough and careful attention; but there should be no delays in getting men back to their gun stations. In most cruisers, it is customary to hold sick call in the sick bay ward or in the space known as the "medical office," which is in reality a single space combining the pharmacy, laboratory, clerical and record office, as well as the office of the medical officer. Holding sick call in either of these spaces has very distinct disadvantages. The disadvantage common to both is that a number of men must pass in and out through a single doorway into a closed compartment. In the ward it disturbs the bed patients and interferes with their treatment and care. It also allows all types of patients to pass directly into the ward without having first examined them to determine which ones should be isolated or segregated. If the sick call is held in the medical office compartment, it greatly interferes with the activities of the corpsman doing laboratory work or the one working in the pharmacy. It is also difficult to examine a patient in close proximity to a typewriter.

On the *U. S. S. Chicago*, the sick bay is located on the second deck, forward. The total space allotted to the Medical Department is about 10,233 cubic feet. The combination pharmacy, laboratory, clerical and medical officer's office, is on the starboard side, and the operating room, ward, and bath on the port side. Between the two there is a passageway roughly measuring 16 feet by 16 feet. A small medical storeroom, approximately 8 feet by 6 feet, is located on the starboard side and after part of this passageway. Therefore, there is an L-shaped passageway of about 1,600 cubic feet between the office and the ward. In order to increase the bed space in the ward the short-wave diathermy emitter, infrared lamps and treatment tables were moved from the ward to the passageway. A surgical bed with gatch frame was installed in the ward in the space previously occupied by the electrotherapy equipment. The makeshift dressing table, previously located in the ward, and which took up much needed space in that compartment was discarded and a simple yet very convenient and practical cabinet was designed and built aboard this ship. The cost of the material for the construction of this cabinet was between $8 and $10. The cabinet was so designed that it contains all of the usual medicines and articles of equipment used in dressings, as well as making routine examinations. The cabinet is located at a point alongside the forward bulkhead about halfway between the ward door and the window to the pharmacy.

Patients enter the passageway directly from a living compartment through the after door. They pass by a small folding table where a corpsman records their complaint, temperature, pulse, etc. They
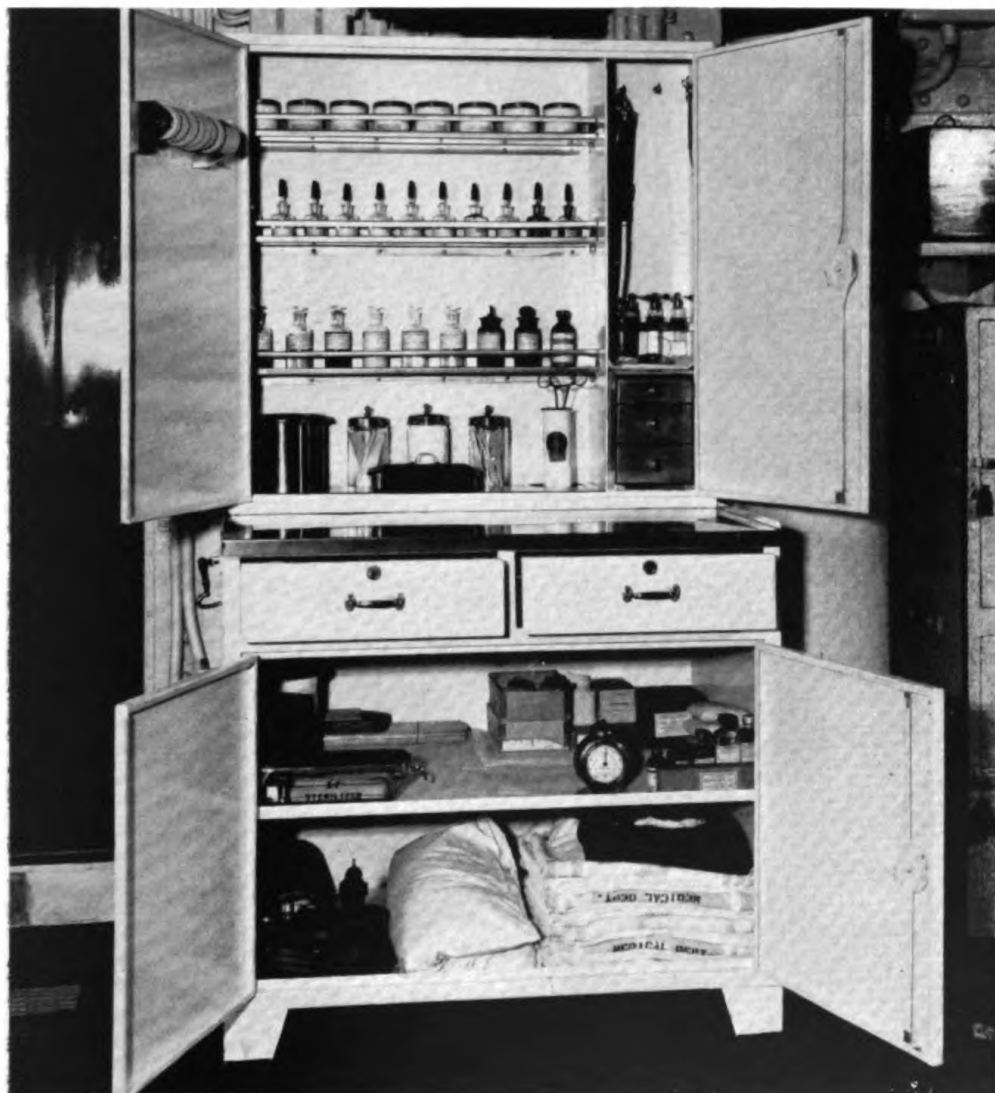
FIGURE 1.—SHOWING CABINET DESIGNED TO STORE MEDICINES AND DRESSINGS.

next pass by the sick call cabinet where the medical officer and corpsman assistant gives treatment; routes those requiring bed care to the ward; and those for medications to the pharmacy window. Men for electrotherapy, massages, etc., are given definite time appointment after the sick call is completed and at times that will not interfere with the patient's duties.

The sick call cabinet has proven of such value and convenience on this ship that a more complete description is furnished for the benefit of other medical officers who may have found their present sick call arrangements to be unsatisfactory.

The cabinet is made of 0.050 gage sheet steel with 0.038 gage stainless steel on the top, shelves and racks. It is 71 inches high by 36 inches wide. The top section is 8 inches deep, while the bottom section is 24 inches deep. The top section contains four shelves with appropriate racks for ointment jars, drop bottles, solution bottles, and other containers, as shown in the accompanying photographs. On the left door is an adhesive dispenser roller. On the right side of the upper section is a compartment which contains hooks for bandage shears, stethoscope, flashlight, etc. In the lower part of this compartment is a rack containing three atomizer bottles and below this rack are three drawers for roller bandages and miscellaneous articles, such as knife blades, eye spuds, and safety pins. The lower section has two large drawers for diagnostic case, sphygmomanometer and extra supplies. The balance of the lower section has ample storage space for sterile dressings, splints, plaster, supplies of bandages, and diathermy equipment. The Sorenson air compressor is placed on the bulkhead shelf shown in the picture at the extreme right. The cabinet is on legs 6 inches high which gives ready access for cleaning the deck. All doors and drawers can be locked and when closed the contents have been found to be safely secure for rough weather or while the ship is engaged in firing.

In preparing for battle much thought has been given to the proper location of medical supplies. In peacetime, stores are kept in two small storerooms which are normally assigned the medical department. Increased armaments and complements have made space at a premium. It is noted however, that in nearly every one of the living compartments that there is a space measuring roughly 23 cubic feet above the heater boxes or in some unused alcove. It is suggested that small lockers can be made of light sheet metal and fitted into these otherwise unused spaces. These lockers would be of sufficient size to allow storage of large quantities of surgical dressings and first aid supplies. Storage of such materials would not be effected by such a location and would not interfere with the proper functioning of the heaters. In time of war if the ship were damaged, the medical department would still have supplies with which to treat the injured personnel.

The author desires to express his appreciation for the excellent workmanship of C. S. Robinson, S. F. 1c, U. S. N., and the help of Chief Pharmacist's Mate J. A. Conlow, U. S. N., and the other members of the medical department for suggestions as to design of the sick call cabinet mentioned in this article.

A TRANSPORT SPLINT FOR FRACTURED SPINES [1]

By Lieutenant Commander George Wagoner, Medical Corps, United States Naval Reserve

Few fractures receive as poor emergency treatment as those of the spine. This negligence is due, first, to faulty diagnosis; and second, to the absence of a simple transportation splint. In order to provide
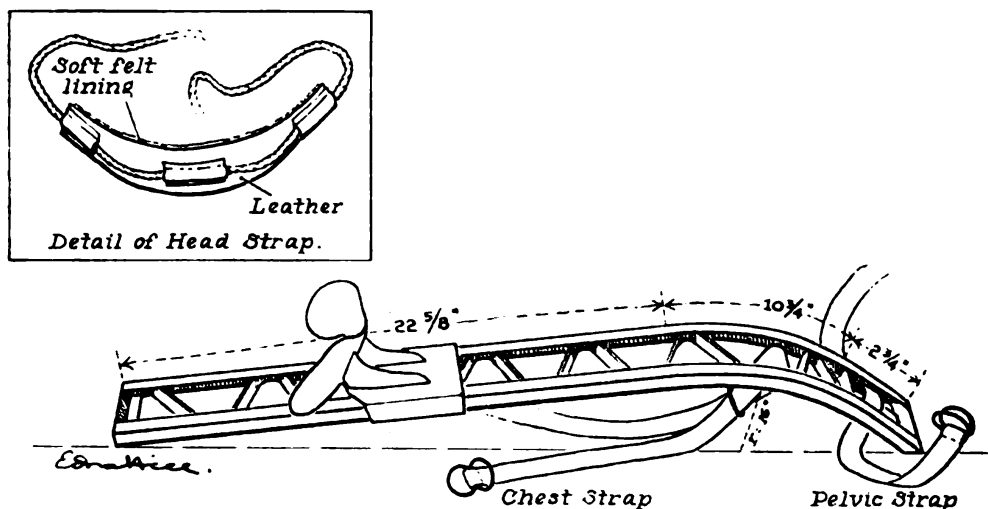
FIGURE 1.—Showing method of construction of splint.
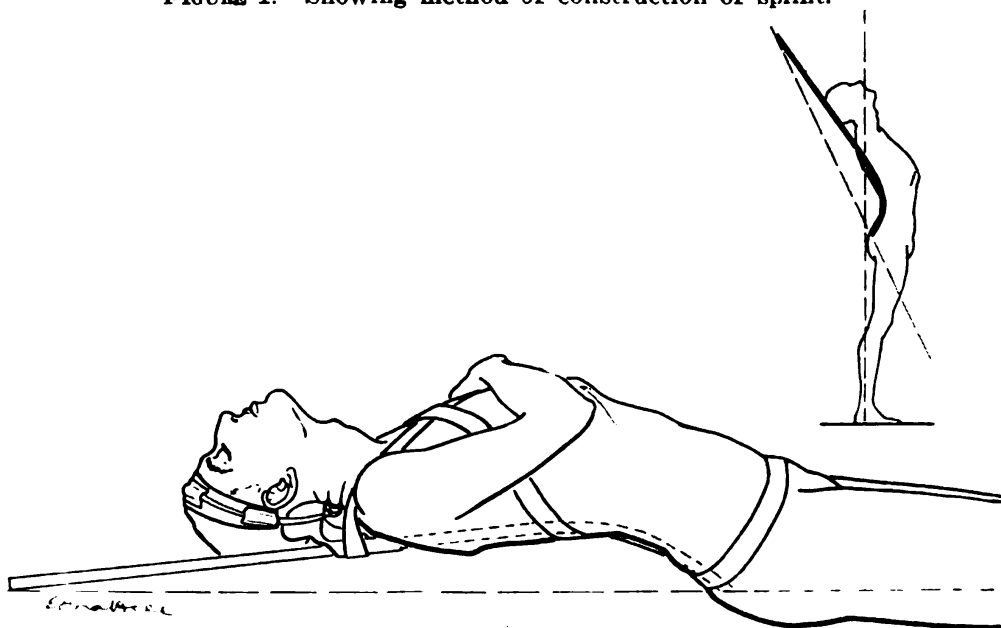
FIGURE 2.—Showing method of application of splint.

a simple transport splint for fractures of the spine, the following apparatus has been designed. Such a splint applied at the scene of the accident should have wide use for war and industrial casualties and street accidents.

The proper handling of fractures of the spine comprises three cardinal points:

1. Removal of weight bearing.
2. Hyperextension of the fractured area of the spine.
3. Immobilization of the fractured area of the spine.

This splint has been proven to provide these three factors.

DESCRIPTION

The splint is an aluminum alloy (U. S. A. No. 96) casting. As illustrated (fig. 1) it consists of two parallel angle bars bent on the flat and joined by diagonal trusses. The length of the splint is 36⅛ inches, its width is 3½ inches. The weight is 3¼ pounds.

The head support is movable to allow for use on individuals of varying heights. Furthermore, the head support is so shaped as to place and hold the head and cervical spine in mild hyperextension but without traction.

The pelvis is held to the splint by a wide webbing strap. The trunk is immobilized by a second strap which is applied so that it crosses the chest twice, in the manner of a bandolier. The intersection of the strap crossing is well cephalad of the intercostal angle so as to minimize interference with respiration.

The curvature of the splint is in its distal third (fig. 2). This provides hyperextension of the lumbar spine. The remainder of the splint is straight. Strapping the thoracic spine to a straight splint produces hyperextension of this area. Hyperextension of the cervical spine, as previously stated, is obtained by strapping the head to the head support.

The splint as illustrated does not provide for broad lateral support of the trunk. This is not necessary in cases which rest upon the splint for a relatively short time (industrial and accident cases). In the cases of war casualties where patients may have to remain upon the splint for a number of hours before they can be given expert care, adjustable lateral wings can be attached to the splint and would add to the comfort of the patient.

NOTES AND COMMENTS

AIR RAID OPHTHALMIC CASUALTIES

"There are three types of ocular injuries that result from air raids," states Dr. Dorothy R. Campbell, noted English ophthalmic surgeon, in the British Medical Journal of June 28, 1941. These types result from (1) explosive incendiary bombs; (2) the sudden compression and expansion of the atmosphere caused by blast; (3) direct blows on the eye.

The blast from an incendiary bomb causes multiple foreign bodies such as sand and oil to be embedded in the eyelids, conjunctivae, and corneae. Multiple burns may also result. Swelling of the lids and conjunctivae and edema of the corneal epithelium, with softening of the ocular tissues, resulted. In most instances only a few of the foreign bodies could be removed at a time. Pain was the predominant symptom. Sulfapyridine by mouth in large doses was given and bad infections were few. Recovery was slow.

Sudden compression caused (1) proptosis due to a sudden retrobulbar hemorrhage with total loss of vision and subsequent optic atrophy; (2) extensive intraocular hemorrhage either from an iridodialysis in which the iris vessels were torn through, or from a torn retinal vessel; (3) one or more ruptures of the choroid appearing as crescentic tears near the optic disks; these were quite different from the familiar contusion changes of the retina and were accompanied by small hemorrhages at the macula, with loss of central vision; (4) acute iritis and acute secondary glaucoma occurred in several cases about a week after injury. These were slow to recover. Investigations were made for any constitutional factor, but they appeared to be due entirely to trauma.

Perforating injuries of the cornea and rupture of the sclera from a direct blow were common injuries, and usually the eye had to be removed. Several cases showed a severe traumatic keratitis with multiple folds in Descemet's membrane. Although the cornea cleared well there were always associated contusion changes in the retina, particularly at the macula, giving rise to defective vision. Several cases of penetrating wounds of the orbit occurred in which large particles of wood and glass were buried deep in the tissues; but the sinuses healed up well, as did wounds of the eyelids. There were no cases of intraocular foreign bodies requiring the use of the magnet.

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THE MEDICAL COMPEND FOR COMMANDERS OF NAVAL VESSELS TO WHICH NO MEMBER OF THE MEDICAL DEPARTMENT OF THE UNITED STATES NAVY IS ATTACHED—1941

This book is the revision of the Medical Compend for Masters of the Naval Auxiliary Service (Medicine Box, United States Navy) published in 1916. Designed originally for the days when naval auxiliaries were manned by merchant seamen, this 1916 edition went through the World War I and was the book to which many a skipper turned for advice and assistance in all sorts of medical and surgical emergencies. It was the principal source of medical information on scores of submarine chasers and other small craft which had no personnel of the Medical Department on board.

With the development of the motor torpedo boat and the increased importance of mosquito flotillas, the need for a new edition of this work became acute. It had long been out of print.

The new edition under the title "Medical Compend for Commanders of Naval Vessels" has now made its appearance, revised and brought up to date. Included are not only first aid and emergency treatment, but elementary preventive medicine and the Navy's methods in respect to hospitalization, quarantine, disinfection, bills of health, and the procedure in case of death. Every effort has been made to make it a useful work.

The cover and type are most attractive. A flexible and very durable cover of navy blue has replaced the old gray board cover of the first work and the title lettered in gold make it a very handsome little book. There are two illustrations of the Navy Medicine Box and its contents as supplied to those small craft which do not have Medical Department personnel attached.

HISTORY OF THE HAMMOCK

The necessity for berthing men in the confined spaces on board ship led early to the adoption of what became one of the most time-honored contrivances of maritime life—the hammock. This useful article was a contribution made by the New World, for until the Columbian voyage it was as unknown to Europeans as the white and sweet potato, tobacco, corn, tomato, maple sugar, quinine, ipecac, chocolate, and other important gifts of the Americas to the Old World. The suitability of the hammock for use on board ship was quickly recognized. This swinging bed adapted itself to the movement of the ship, and as it could be rolled up and stored away when not in use, left the berthing spaces clear of encumbrances such as built-in bunks. There is an interesting story of the introduction of the hammock into the British Navy. It was officially adopted in the time of Elizabeth.

When the expenditure for the purchase of hammocks was brought before the Queen for approval, Elizabeth, who was noted for her parsimony, inquired as to the number of men habitually on watch. As the crew, then as now, was divided into a port and starboard watch, she was told that usually half of the crew was on watch at one time. She then approved only the purchase of half the number of hammocks as men, those going below using the hammocks of the watch turned out who thus left a warm hammock for the watch going below.

After more man 300 years the hammock, like sails, is disappearing from the ocean, both in the merchant marine where it was universally used, and in the navies of the world. The metal bunk is replacing it. It has not gone entirely, however, and certain features of its use are so practical that it may not entirely disappear. Its greatest value perhaps is that it left the berthing space free during working hours and this feature alone makes many people reluctant to see the hammock displaced by the more prosaic bunk made from iron pipe.

THE TREATMENT OF SCABIES WITH SULFUR POWDER

Scabies is one of those common diseases frequently seen by the medical man, both in civil life and in the military service. Any phase of its treatment, any new remedy, or any new use of an old remedy is therefore of interest. The method of treatment described by Sherwell may be considered the new use of an old drug; in fact, probably the oldest employed as well as the most effective remedy in the treatment of scabies. There is evidence that sulfur in some form has been used in the treatment of skin diseases for a thousand years before the Christian Era. The principal advantage of the Sherwell method is that it avoids the use of sulfur in ointment form. Ointment, if applied over an extensive area of the skin, is always a disagreeable type of therapeusis. Many of the ointments are not only "messy" but distinctly malodorous. Injury to clothing also often results from their use.

Sherwell's method consists in the application of powdered sulfur in the form of washed sulfur or flowers of sulfur. He recommends an initial bath with hot water and soap just after which the body is thoroughly dried and lightly rubbed with the powdered sulfur. As the lesions are usually thickest about the hands, particularly between the fingers, a little of the powdered sulfur should be taken in the palms and the hands rubbed together, going through the motion of "washing the hands" with a little of the powder. A half teaspoonful of the flowers of sulfur is sufficient for an adult. Another half teaspoonful of sulfur is sprinkled between the sheets of the bed at night. It is desirable to have the person sleep without nightclothes. This treatment should be repeated at least 3 times. Intervals of 2 days to a week

between treatments are satisfactory, the longer time being used if there is any skin irritation which may be ascribed to the sulfur. About 10 days after the last application another treatment should follow to pick up any possible parasites which may have escaped. Particular care should be taken in regard to the underwear, which must be boiled to prevent reinfestation from this source.

The advantages of the method are that it avoids the disagreeable effects experienced with ointments; it is simple of application even with children; and it is less likely to produce dermatitis than other methods.

HELPFUL SUGGESTIONS REGARDING THE PREPARATION OF MEDICAL DEPARTMENT REQUISITIONS

The naval medical supply depots have requested the publication of some suggestions respecting the obtaining of medical supplies from the depots. It is believed that the following suggestions will lessen the interval between the date of request and that of the receipt of the items; for if requisitions are not properly prepared or do not contain the full information necessary, delay and difficulties are bound to occur. On some of them, the omission of important data may require correspondence and consequent delay. The following are some of the points which it has been suggested will expedite the filling of requisitions and shipment of medical supplies:

1. Prepare S. D. requisitions in accordance with the instructions in the Supply Catalog and Appendix D, Manual of the Medical Department, Bureau Circular Letter F, dated May 26, 1941.

2. Particular attention is invited to the necessity of indicating the types and voltage of electric current, proper identification of parts (when required) and the identification of the unit or apparatus, serial numbers, etc., for which the part is required.

3. "Emergency" requisitions should be limited to items and quantities required *immediately* to meet needs until regular or replenishment S. D. requisitions are submitted, particularly when air mail, air express, railway express or other costly method of shipment is desirable.

4. Bearing in mind transportation difficulties, congestion and delays, until afloat should submit S. D. requisitions to the Bureau well in advance of overhaul or "in port" periods.

5. When possible, replenishment S. D. requisitions should be submitted to the Bureau not less than 1 month in advance of the time material is required, due allowance being made for transit time. If at the time the requisitions are prepared certain items are desired at an early date, those items should be listed in a *separate requisition* and an appropriate comment made under "remarks."

6. Requisitions for material such as beds, chairs, bedside lockers, mattresses, overbed tables, sterilizers, x-ray units, and similar major items required to outfit or expand shore stations should be submitted at the earliest possible date and bear a statement as to the tentative date material is desired or *can be received.*

7. Dispatch or letter inquiry relative to prospective shipment of material should be limited to urgently necessary items. When such communication cannot be

avoided, care should be observed to accurately identify the *proper name of the ship or station*, the *S. D. requisition number*, the *item number, stock number*, and the *name of the material*.

THE WELLCOME PRIZE FOR 1941

The Association of Military Surgeons have announced that the winner of the Wellcome Prize for 1941 is Lieutenant A. R. Behnke, Medical Corps, United States Navy.

The award of the gold medal and the cash prize of $500 was made at the annual meeting of the Association at Louisville, Ky., the latter part of October. This meeting was the fiftieth anniversary of the founding of the Association. It was begun in 1891 in Milwaukee by a group of medical officers of the National Guard of Wisconsin under the leadership of Dr. Nicholas Sim.

Last year this prize was won by Captain Lucius W. Johnson, also of the Medical Corps, United States Navy.

ESTABLISHMENT OF ALLERGY AS A RECOGNIZED SPECIALTY IN THE NAVY

Recently, the Commanding Officer of the Naval Medical School recommended that allergy be officially recognized as a specialty in the Navy and that postgraduate training in the subject be instituted. This recommendation was considered by the Advisory Board and was approved by the Surgeon General of the Navy. The rapid increase in the scope of clinical allergy and the wide recognition of its importance in the field of medicine and surgery makes this step a necessary one.

For a time, at least, preference will be given to requests for postgraduate instruction in the subject received from medical officers on duty at dispensaries or in family practice. As allergy is a recognized specialty of internal medicine, short courses for recognized internists will also be considered. Arrangements are being made with important medical colleges and also with some leading allergists in private practice to provide such instruction.

FORMER SURGEON GENERAL OF THE NAVY RECEIVES THE THEOBALD SMITH MEDAL

Rear Admiral E. R. Stitt, Medical Corps, U. S. Navy, retired, was given the Theobald Smith gold medal of the George Washington University at the eighth annual meeting of the American Academy of Tropical Medicine at St. Louis. Presentation of the medal was made at a dinner in the Adam Room of the Hotel Statler in St. Louis by Dr. W. W. Cort, Professor of Helminthology at Johns Hopkins University.

Dr. Stitt, a former Surgeon General of the Navy and also a former president of the Association of Military Surgeons of the United States, is, of course, well known as the author of two of the most widely used textbooks, one on tropical medicine, and the other on laboratory procedures. In the most far away corners of the earth, laboratory technicians have a reagent-spattered and thumb-marked copy of "Stitt" propped up on a microscope desk as a ready reference. The textbook of tropical medicine has attained almost the position where it has become "The Osler of tropical medicine." Dr. Stitt is, without doubt, one of the most suitable recipients of any honor received for eminence in the field of tropical medicine and tropical hygiene.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,
UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington, D. C.

(For review)

TRAUMA AND DISEASE by *Leopold Brahdy, B. S., M. D.* and *Samuel Kahn, B. S., M. D.,* 655 pages with illustrations. Lea & Febiger, Philadelphia, publishers, 1941. Second edition. Price $7.50.

Since industrial medicine has grown so rapidly with a consequent rise in accident rates, and with resultant increase in compensation laws, this book is timely. Every phase of the subject of industrial medicine is covered in this symposium by 24 well-known authorities. The relationship of accident to the individual patient is, however, the book's particular field. The role of trauma is without doubt overestimated by the lay public, and the etiological relationship between trauma and disease, though always recognized, has not been given the attention which its importance merits. This symposium presents the accumulated knowledge concerning the relationship of a single trauma to disease, and also points out the limitations of this knowledge. On the other hand the underlying principles on which medical opinions should be based are given.

Each chapter presents the relationship between trauma and an anatomical system, such as "Trauma and Heart Disease"; "Trauma and Peripheral Vascular Disease"; etc. At the end of each chapter is a large bibliography which makes the book a value as a reference text.

The book is well indexed and the print is such that it is easily read. The book is recommended to both the general practitioner and specialist.

MACLEOD'S PHYSIOLOGY IN MODERN MEDICINE, edited by *Philip Bard, Professor of Physiology, Johns Hopkins University School of Medicine;* with the collaboration of *Henry C. Bazett, Professor of Physiology, University of Pennsylvania, et al.* Ninth edition, 1256 pages with 387 illustrations. The C. V. Mosby Co., St. Louis, Mo., publishers, 1941. Price $10.

The ninth edition of this familiar and authoritative work maintains the uniform excellence of the previous editions. As stated by the late

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Professor Macleod, the original purpose of this book was to serve as a guide to the clinical application of physiology and biochemistry. Later its scope was extended in order that it might be used as a textbook of physiology for students of medicine and care was taken to bring up to date those subjects for which no application might be evident. Professors Bard and Bazett with their collaborators have continued this trend. The author of each section has been actively engaged in some phase of the subject of which he treats, thus assuring first hand and authoritative information in each of the many complex phases of this subject.

The chapters on the circulation of the blood, the heart, the respiration and the section on metabolism and nutrition will be of particular value to the medical officer. The practice of scientific medicine requires a basic knowledge of physiological processes, which knowledge must be kept abreast of the many advances in this field. This book is admirably suited to that purpose. It is the opinion of the reviewer that this book is the outstanding work in this field.

THE DIVISION OF ORTHOPAEDIC SURGERY IN THE A. E. F., by *Joel E. Goldthwait, Brigadier General, Medical Corps, Auxiliary Reserve, Director of the Division, and later Senior Consultant in Orthopaedic Surgery.* 133 pages. Privately printed at the Plimpton Press, Norwood, Mass., U. S. A., 1941. Price $2.50.

This book is privately printed and is an historical account of the division of orthopaedic surgery of the American Expeditionary Forces during World War I. The type of organization described, and the methods of transportation of the wounded might still be used. The book is well written and easily read. The last 5 pages contain an alphabetical list of officers designated for the orthopaedic division, A. E. F.

HANDBOOK OF COMMUNICABLE DISEASES, by *Franklin H. Top, A. B., M. D., M. P. H., Major, Medical Reserve Corps, United States Army,* and *Collaborators.* 682 pages with 73 text illustrations and 10 color plates. The C. V. Mosby Co., St. Louis, publishers, 1941. Price $7.50.

This book is divided into 2 sections. The first section discusses the general considerations applicable to communicable diseases. The second section discusses communicable and infectious diseases classified by a common portal of entry, such as the respiratory tract, the gastro-intestinal tract, the mucous membrane, etc. The material is well organized as to the history, etiology, epidemiology, immunity, pathology, symptoms, complications, differential diagnosis, prognosis, and treatment. There are 73 illustrations and 10 color plates. The print and paper makes the book easily readable. The collaborators are well known and the material presented well organized. For those whose professional duties necessitate contact with communicable diseases, this book is valuable as a text or handy reference.

CLINICAL IMMUNOLOGY, BIOTHERAPY, AND CHEMOTHERAPY in the Diagnosis, Prevention, and Treatment of Disease, by *John A. Kolmer, M. S., M. D., Dr. P. H., Sc. D., LL. D., L. H. D., F. A. C. P., Professor of Medicine, Temple University School of Medicine; Director of the Research Institute of Cutaneous Medicine;* and *Louis Tuft, M. D., Assistant Professor of Medicine and Chief of Clinic of Allergy and Applied Immunology. Temple University School of Medicine.* 941 pages, illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1941. Price $10.

This book, by 2 well known authors, is divided into 2 parts. The first part is devoted to the general aspects of infection, immunity, biotherapy, and chemotherapy, which the authors believe is of fundamental importance to the understanding of the practical application of these subjects in the diagrams, prophylaxis, and treatment of disease covered in part II. Each disease described in part II is divided into general considerations, etiology, pathogenesis, immunity, symptomatology, and clinical diagnosis; biotherapy, chemotherapy, and general treatment; bibliography, and summary. The summary is an asset to the book in that the reader can, at a glance, get a quick resume of the disease, and if necessary get the detailed information in the text. The book is well illustrated and well indexed. It is recommended to the student, specialist, and general practitioner.

A MANUAL OF BANDAGING, SPLINTING AND STRAPPING, by *Augustus Thorndike, Jr., M. D., F. A. C. S.* 144 pages illustrated with 117 engravings. Lea & Febiger, Philadelphia, publishers, 1941. Price $1.50.

A handy manual demonstrating the proper technic in dressing, bandaging, and splinting. It should prove valuable to instructors and students, as well as to the layman learning first aid.

ESSENTIALS OF GENERAL SURGERY, by *Wallace P. Ritchie, M. D., Clinical Assistant Professor, Department of Surgery, University of Minnesota Medical School.* 813 pages, with 237 illustrations. The C. V. Mosby Co., publishers, 1941. Price $8.50.

This book is written in order to give the beginning student a basic outline of the important points to be learned and the advanced student an outline of review by means of which he may recall the more extensive works with which he should have contact. The book is well illustrated and well indexed, and the print and paper make it easily read. For the student or those contemplating a review this book is recommended.

MANUAL OF THE DISEASES OF THE EYE, For Students and General Practitioners, by *Charles H. May, M. D.* Seventeenth edition, revised; 519 pages with 387 illustrations, including 32 plates, with 93 colored figures. William Wood & Co., Baltimore, Md., publishers, 1941. Price $4.

The new edition (XVII) has been carefully revised, and some parts rewritten. Two new color plates have been added, as well as a number of photographs. There is included an appendix giving the ocular

requirements for admission to the Army, Navy, Marine, and Air Services of the United States. The author has not increased the size of the book by these changes, and the book still is the handy size it has always been. The book is so well known that if a Gallup poll among physicians could be held to name the 10 best and most useful medical books, it is certain that May's "Diseases of the Eye," would stand high in such a census.

SULFANILAMIDE AND RELATED COMPOUNDS IN GENERAL PRACTICE, by *Wesley W. Spink, M. D., Associate Professor of Medicine, University of Minnesota Medical . chool.* 256 pages, illustrated. The Year Book Publishers, Inc., 304 South Dearborn St., Chicago, Illinois, publishers. Price $3.

This is a handy manual and covers all the sulfanilamide compounds on the market today. Each of the five important compounds, sulfanilamide, sulfapyridine, sulfathiozole, sulfaguanidine, and sulfadiazine, is described completely in a chapter by itself. Indications, dosage, and details of administration are well described. It points out the precautionary measures necessary before use. There is a large bibliography and the book is well indexed.

MICROBES WHICH HELP OR DESTROY US, by *Paul W. Allen, Ph. D., Professor of Bacteriology and Head of the Department, University of Tennessee; D. Frank Holtman, Ph. D., Associate Professor of Bacteriology, University of Tennessee; and Louise Allen McBee, M. S., Formerly Assistant in Bacteriology, University of Tennessee.* 540 pages with 102 text illustrations and 13 color plates. The C. V. Mosby Co., St. Louis, publishers, 1941. Price $3.50.

The authors have succeeded in producing a book on bacteriology that the average layman can read and understand. They describe the various micro-organisms in relation to disease and show the reader the necessity of becoming microbe-conscious. There are 13 colored plates and numerous photographs, illustrating clearly the various organisms that the layman has heard about but never seen. It is well written and those who read this book will have a clearer and better understanding of the relation of microbes to disease.

PUBLIC HEALTH AND HYGIENE, A Student's Manual, by *Charles Frederick Bolduan, M. D., Director, Bureau of Health Education, Department of Health, City of New York; Surgeon (R.), U. S. Public Health Service, and Nils W. Bolduan, M. D., Children's Medical Service, Bellevue Hospital, New York; Medical Director, School Health Service, Scarsdale, N. Y.* Third edition, illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1941. Price $3.

In this volume, the third edition of a work first published in 1929, the authors provide practical teaching material on this important subject.

The opening chapters are devoted to the history of public health and hygiene and the effect of micro-organisms on the body. Considerable thought is given to the more important communicable diseases,

the disorders of nutrition, and the various other factors which contribute to better living conditions, such as water supply, sewage disposal, food inspections, industrial hygiene, and health education, both in the home and the schools.

The last 5 chapters are devoted to health administration, and leave no doubt in the reader's mind that well-directed public health work is an investment which pays excellent dividends in real money as well as in good health and a clean community.

THE NEW INTERNATIONAL CLINICS, Volume II, New Series Four, 1941, Original
   Contributions: Clinics and Evaluated Reviews of Current Advances in the
   Medical Arts. Edited by *George Morris Piersol, M. D., Professor of Medicine,
   Graduate School of Medicine, University of Pennsylvania, Philadelphia, Pa.,*
   with the collaboration of 17 prominent physicians. 299 pages. J. B. Lippincott
   Co., Philadelphia, Pa., publishers, 1941. Price $3.

This periodical resembles other current "clinics." The topics are conveniently grouped into original contributions, clinics, and review of recent progress. Editor Piersol has for collaborators master teachers from all sections of the country, as well as one each from Canada and England. This staff is an integral clinical group with internists predominant. The subjects covered reflect a fine sense of selection and there is a sound balance between the erudite and the clinical.

The papers on cryptorchidism by Hamilton and Hubert, and on chronic gastritis by Tumen and Lieberthal are on a high plane. Lavieties and Peters, in their treatment of diabetes briefly and critically review new practices in an article which deserves more than one reading.

THE CARE OF THE AGED, by *Malford W. Thewlis, M. D.* Third edition, entirely
   rewritten, 579 pages, with 50 illustrations. The C. V. Mosby Co., St. Louis,
   publishers, 1941. Price $6.

Geriatrics is becoming more and more a specialty since the number of people alive today past the age of 60 is much larger than in the last century. Special problems are met in treating these people because many are peculiar to the aged and require special therapeutic procedures. The author has presented the problems and care of the aged to the reader in such a manner that the book is most valuable to those treating the ills of senescense.

The book is divided into five sections; general considerations are taken up in section I; miscellaneous medical problems in section II; specific infections in section III; noninfectious diseases in section IV; pathologic conditions in old age in section V.

There are 50 illustrations and 15 charts. Each chapter contains a separate bibliography which can be used as a reference. It is well indexed and the print makes it easily read. There are a number

of well-known contributors, specialists in their field, who aided the author in preparing this book.

The book is recommended not only for those specializing in geriatrics, but to the general practioner as well.

THE CYCLOPEDIA OF MEDICINE, Service Volume, 1941, edited by *George Morris Piersol, B. S., M. D.*, and *Edward L. Bortz, A. B., M. D.*　979 pages, fully illustrated.　F. A. Davis Co., Philadelphia, Pa., publishers, 1941.　Price $10.

This is the 1941 Service Volume that supplements the original work and brings up to date the material previously published in the Cyclopedia.　The contributors and editors are well known in the field of medicine and surgery and have emphasized only the points of proven value.　Two subjects: aviation medicine and war surgery have been added.　The work is well printed, indexed, and illustrated.

AN INTRODUCTION TO MEDICAL SCIENCE, by *William Boyd, M. D., M. R. C. P. (Edin.), F. R. C. P. (Lond.), DIPL, PSYCH., F. R. C. (Canada), Professor of Pathology and Bacteriology in the University of Toronto, Toronto; formerly Professor of Pathology in the University of Manitoba; Pathologist to the Winnipeg General Hospital, Winnipeg, Canada.*　Second edition, thoroughly revised. 358 pages, illustrated with 124 engravings.　Lea & Febiger, Philadelphia, Pa., publishers, 1941.　Price $3.50.

This book, written for the beginner in nursing, is a general introduction to the study of disease, its causes, and the bodily changes which accompany it.　The first session of the book deals with the general principles of disease, the second with the diseased organs, and the third with some practical applications.

The subject matter is soundly, if briefly, presented.　The nurse or hospital corpsman will profit from its study.

SURGICAL NURSING, by *Hugh Cabot, M. D., C. M. G., F. A. C. G., formerly Senior Consultant, Mayo Clinic, Rochester, Minnesota,* and *Mary Dodd Giles, R. N., A. M., Instructor, Children's Hospital, Los Angeles, California; formerly Associate Professor of Nursing Education, Vanderbilt University.*　Fourth edition, revised, 513 pages, illustrated.　W. B. Saunders Co., Philadelphia, Pa., publishers, 1940.　Price $3.

In this, the fourth edition of this valuable book, the authors have faithfully endeavored to bring it abreast of and into step with a changing scientific and social environment.　The more modern conception of the proper relationship between the surgeon and the nurse is emphasized.　Moreover the obligation of each in the anticipated future scheme of health service is touched upon.　A revision of the subject matter embodies the entirely new considerations of intravenous anaesthesia, water balance, and the latest achievements in the field of chemotherapy.　The chapter on Gynecologic Nursing is entirely new.　The subject matter dealing with pre- and postoperative care has been rewritten.　Surgical principles and surgical nursing

have been concisely and comprehensively expounded and much valuable and helpful information is contained therein. Its style is simple and attractive. Its substance is clearly and logically apportioned into 27 chapters. It is very legibly printed on a good quality of paper, amply illustrated, and well bound.

PATHOLOGY OF THE ORAL CAVITY by *Lester Richard Cahn, D. D. S., Associate Professor of Dentistry (oral pathology), Columbia University, Fellow of the American Association for the Advancement of Science, Fellow of the New York Academy of Dentistry, Associate Fellow of the New York Academy of Medicine.* 240 pages, illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1941. Price $5.50.

This book deals with pathology of lesions most commonly found in the oral cavity in every day practice, namely: inflammation; diseases of the teeth, pulp, and periapical tissues; pyorrhea alveolaris; cysts; affectations of the jaw bones and tongue; osteomyelitis; histology and pathology of the soft tissues; gingivitis and stomatitis; ulcers; leukoplakia; tumors of the soft tissues; pigmentation; lesions associated with blood dyscrasia, with endocrine dysfunction, with avitaminosis. No treatment is given.

It contains 166 illustrations, of which 8 are in colors. The choice of material and illustrations are excellent. It is well bound, the type clear, and the style of presentation very readable. This book should be an excellent text and a very valuable reference in oral diagnosis.

SYNOPSIS OF DISEASES OF THE HEART AND ARTERIES, by *George R. Herrmann, M. S., M. D., Ph. D., F. A. C. P., Professor of Medicine, University of Texas, Director of the Cardiovascular Service, John Sealy Hospital, consultant in vascular disease, U. S. Marine Hospital.* Second edition, 468 pages, illustrated. The C. V. Mosby Co., St. Louis, Mo., publishers, 1941. Price $5.

The reviewer agrees with the author that, "This guide should foster interest and proficiency in cadiovascular diagnosis and treatment and should be of help to the hard-pressed student and to the busy practitioner." The book is more than a synopsis, it is a comprehensive, well-illustrated text and reference book written in a crisp, easily read style. The subject matter is logically presented in outline form in 26 chapters. Chapter I contains a list of diagnostic criteria, each of which is briefly but adequately discussed. The chapter on the radiologic study of the heart is of particular value because of its excellent diagrammatic illustrations. The biophysics of the heart action with its relationship to electrocardiography, which is so essential for the proper understanding of electrocardiology, is simply described and easily understood. The final chapter on Military Cardiovascular Examination and Interpretations is of particular interest at this time. The book itself is well-bound, of good

materials, and is of handy size. This is an excellent book for the general practitioner or the specialist in other fields who is called on, at times, to be his own cardiologist.

OBSTETRICS FOR NURSES, by *Joseph B. DeLee, A. M., M. D., Professor of Obstetrics and Gynecology, Emeritus, University of Chicago;* and *Mabel C. Carmon, R. N., Chief Supervisor and Instructor, Chicago Lying-in Hospital and Dispensary.* Twelfth edition; 651 pages, illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1941. Price $3.

The authors have revised their book and brought it completely up to date.

A new emphasis has been placed on diet, drugs, and surgical procedures in the care of mothers through pregnancy, and also the modern method of caring for the premature as well as the full-term infant.

The questions for review at the end of each chapter stress the most important points.

This book could be used to good advantage by the nurses on duty in the out-patient clinics of Naval hospitals.

GOULD'S MEDICAL DICTIONARY, Words and Phrases Generally Used in Medicine and The Allied Sciences, With Their Pronunciations and Derivations, edited by *C. V. Brownlow.* Fifth revised edition. 1527 pages, illustrated. The Blakiston Co., Philadelphia, publishers, 1941. Price $7.50.

This edition contains several hundred new words and many of the old definitions in medicine and chemistry have been corrected. It is of special interest to the Navy medical reader that the colored microphotographs of malarial parasites and the photographs of intestinal protozoa were obtained from the United States Naval Medical School. Furthermore, like other illustrations in the book, they are remarkably fine. The book contains excellent tables of arteries, veins, bones, and nerves. The table of micro-organisms requires 67 pages and contains the original name, where found, character, and new classification. The appendix contains a number of dosage tables both for the physician and veterinarian. The bold type for headings, the size of the print, and the nonglossy paper makes it easy reading.

THE PRINCIPLES AND PRACTICE OF OPHTHALMIC SURGERY, by *Edmund B. Spaeth, M. D., Professor of Ophthalmology in the Graduate School of Medicine of the University of Pennsylvania, Philadelphia.* Second edition, thoroughly revised, illustrated. Lea & Febiger, Philadelphia, publishers, 1941. Price $10.

This is the second edition of this valuable and comprehensive work on ophthalmic surgery. All phases of ophthalmic surgery are included such as the surgery of exophthalmos, the lacrimal sac, ocular muscle surgery, plastic eye surgery, the surgery of the eye per se, and recent

innovations in eye surgery such as the surgical treatment of retinal detachment.

One chapter is devoted to surgical anatomy of the globe, and is especially written for this text by Dr. Thomas Cowan.

The chapter on corneal transplants or keratoplasty was written by Dr. Ramon Castroviejo, and this subject matter is brought up to date.

One of the latest procedures in the treatment of simple noninflammatory glaucoma devised by Dr. Otto Barkan is explained by him. This procedure is called "goniotomy" or opening of Schlemm's canal under direct vision using a special surgical contact glass.

The chapter devoted to traumatisms of the globe and the removal of intra-ocular foreign bodies should be of interest to every Naval medical officer. The author feels that removal of intra-ocular foreign bodies by posterior sclerotomy is the safest procedure.

This text is one that should be in the library of all medical officers practicing ophthalmology. It is the most complete text on eye surgery by an American author. The author is a former medical officer of the United States Army.

NERVOUS AND MENTAL DISEASES FOR NURSES, by *Irving J. Sands, M. D., Assistant Clinical Professor of Neurology, Columbia University, N. Y.* Fourth edition, reset; 354 pages, illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1941. Price $2.25.

The subject of this book is well arranged, beginning with the elementary neuro-anatomy, and the importance of the endocrines, later taking up the nature, causes, symptoms, and classification of various mental diseases.

The chapters on the development of modern psychiatry, and mental hygiene are especially interesting and of value in caring for the mentally sick.

This book would be a useful and a valuable addition to any nurses' library.

NEURO-OPHTHALMOLOGY, by *R. Lindsay Rea, B. Sc., M. D., M. Ch., F. R. C. S., Ophthalmic Surgeon to West End Hospital for Nervous Diseases.* Second edition, 688 pages, illustrated. The C. V. Mosby Co., St. Louis, Mo., publishers, 1941. Price $13.50.

The first edition of this work, which appeared in 1938, was accorded an enthusiastic reception, and the author's hope that it would supply a long-felt need in correlation with the fields of ophthalmology and neurology, was fulfilled. The book accomplished its purpose in supplying this long-felt need in a most thorough manner so that the demand required another reprinting the same year. The second edition is an unrevised version of the first, with the addition of an appendix which includes recent developments. The bibliography and the

index have been revised to include the new references. There are 627 pages of text, 22 excellent colored plates, and 196 illustrations. The book is well bound and nicely printed.

The sections containing the original work that treat such conditions as tumors of the optic nerve, the chiasma, and the pituitary gland are complete in every detail; and the chapters that discuss ocular manifestations in diseases of the central and vegetative systems, and the one that describes congenital and degenerative anomalies are well written. There is an extensive chapter on the poisons which affect vision.

The second edition has been made more useful to students by including in the appendix, a chapter on ocular muscle anomalies. Other topics discussed at some length in the appendix are: The effects of compression on the chiasma, optic nerves and optic tracts; tumors of the optic nerve and similar types of tumors found in the brain; present knowledge of the hypothalamus; intracranial aneurysms; Sturge's disease; uveoparotitis; vitamins in ophthalmology.

The text is easily readable, very thorough in its coverage of many interesting subjects, and cannot fail to be of great help to the clinician. The author, an ophthalmologist, who might be expected to digress now and then to consider emergent tendencies in his own field, seldom loses sight of his objective.

INFANTILE PARALYSIS. A Symposium Delivered at Vanderbilt University, April 1941. Published by The National Foundation for Infantile Paralysis, Inc., 120 Broadway, New York City. Price $1.25.

This book published by the National Foundation of Infantile Paralysis contains 6 lectures delivered at Vanderbilt University in April 1941. The lectures were given by well-known men in the field of medicine and bring together a resume of the present day knowledge of infantile paralysis. Besides the papers, the book contains an alphabetical bibliography of 575 references. This book is recommended for both the specialist and the general practitioner.

ELIMINATION DIETS AND THE PATIENT'S ALLERGIES. A Handbook of Allergy, by Albert H. Rowe, M. D., Lecturer in Medicine, University of California. 264 pages. Lea & Febiger, Philadelphia, Pa., publishers, 1941. Price $3.

For 15 years the author has used elimination diets in the study of patients with food allergies. He has here given the reader the result of these studies and has included the various diets for diagnostic purposes. The book also contains causes of allergy, the method of pollen extraction, pollen units, etc. The print is large and the book well indexed.

ESSENTIALS OF ENDOCRINOLOGY, by *Arthur Grollman, Ph. D., M. D., Associate Professor of Pharmacology and Experimental Therapeutics in the Medical School of the Johns Hopkins University.* 480 pages, illustrated. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1941. Price $6.

The material in this book has been assembled in such a manner that it can be used as a handy reference as well as an excellent text. Each section discusses separately a glandular system, such as "Endocrine glands of the cranial cavity, the bronchogenic organs, endocrine glands of the abdominal cavity, hormones of the reproductive system, and hormones derived from nonendocrine organs." Under each system, the author discusses the orientation, anatomy, comparative anatomy, embryology, gross anatomy, histology, secretory mechanism, physiology, etc. The print is large, easily read and the book well indexed.

PAPERS OF WADE HAMPTON FROST, M. D. A Contribution to Epidemiological Method, edited by *Kenneth F. Marcy, M. D* The Commonwealth Fund, New York, publishers, 1941. Price $3.

The author has been an officer of the United States Public Health Service and a professor of epidemiology at the Johns Hopkins University School of Hygiene and Public Health. In this book his friends have brought together the most important writings and contributions to preventive medicine in his brilliant career. Those interested in epidemiology will find this book of the greatest value as well as interesting.

DIETETICS FOR THE CLINICIAN, by *the late Milton Arlanden Bridges, B. S., M. D., F. A. C. P., director of medicine, Detention, Rikers Island, and West Side Hospitals, New York.* Fourth edition, thoroughly revised. 960 pages. Lea & Febiger, Philadelphia, publishers, 1941. Price $10.

The fourth edition of this book has undergone many revisions. The section on vitamins as well as the therapy has been brought up to date. The book is divided into sections, each dealing with a certain phase of diets. One section contains correct diets for all the systemic diseases. The mechanics as well as the physiology and chemistry of digestion is discussed. The book also contains excellent references in food factors and vitamin values as well as the practical evaluation of foods. There is an excellent bibliography and index.

FIT TO FLY. A Medical Handbook for Fliers, by *Malcolm C. Grow, M. D., Lieutenant Colonel, Medical Corps, United States Army,* and *Harry G. Armstrong, B. S., M. D., Captain, Medical Corps., United States Army.* 387 pages. D. Appleton-Century Co., Inc., publishers, New York, 1941. Price $2.50.

This book is written by 2 well-known authors in the field of aviation medicine and they have written it for those contemplating flying, for the new pilot, and for the veteran who has to keep physically fit. They have given the reader a clear picture of the importance

of maintaining health, whether he be an amateur, professional, or service flyer. Among the subjects discussed are the procedures of various examinations, diseases of the heart and circulatory system, disqualifying defects, care of the eyes, examination of the nervous system, altitude sickness, oxygen, fatigue in flight, aviators' diet, mental hygiene, protective devices, sensory illusions during flight, aviation accidents and first aid and tropical diseases. The book is illustrated and contains a foreword by Maj. Gen. H. H. Arnold, former Chief of Air Corps, United States Army. It is recommended to both those contemplating flying and to the veteran pilot.

ROENTGEN INTERPRETATION, by *George W. Holmes, M. D., Roentgenologist to the Massachusetts General Hospital and Clinical Professor of Roentgenology, Harvard Medical School,* and *Howard E. Ruggles, M. D., late Roentgenologist to the University of California Hospital and Clinical Professor of Roentgenology, University of California Medical School.* Sixth edition, thoroughly revised. 364 pages, illustrated with 246 engravings. Lea & Febiger, Philadelphia, Pa., publishers, 1941. Price $5.

This work, now in its sixth edition is an old familiar friend. It has provided a brief, sound and practical resume of roentgenological diagnostics for almost a generation. The present edition has naturally been enlarged and brought up to date and so presents a more adequate survey than heretofore. However, it still retains a conveniently small size.

The book starts with a consideration of confusing shadows and artefacts and of anatomical variations and deviations. This gives proper emphasis to a very important and fundamental feature of radiology, helps inculcate caution and tends to bring about the realization that in radiological diagnostics, one has to work in a weird shadowland where appearances are only too often deceptive.

The table of epiphyseal ossification is very complete and a list of "areas to be taken for bone age determination" is also given. Chapters follow on all the various systems, consideration being brief but adequate and practical as to all fundamentals. Illustrations are good and accompany the text, which I believe is a more desirable procedure than lumping all the illustrations together in the back as an appendix.

General description of the various pathological appearances is well phrased and easy to follow. The book is thus both pleasant and valuable to read for purposes of general review and reference. It is, of course, not to be expected that complete coverage of each subject will be given; for such one turns to special works of reference. Innovations such as photofluorography, laminography, or kymography are not taken up. This is somewhat regretable but in a book of this type such omissions are more or less to be expected.

and most important indications for their use. Also there is a chapter discussing the eye in general diseases. The appendix deals with the determination of the loss of visual efficiency as approved by House of Delegates of the American Medical Association.

This, the second edition, has been revised in some parts and in others it has been rewritten to bring the book up to date. There are 215 illustrations as well as 16 plates and 4 charts.

The reviewer considers this an excellent small textbook of ophthalmology.

EFFECTIVE LIVING, by *C. E. Turner, A. M., Sc. D., Dr. P. H., Professor of Biology and Public Health, Massachusetts Institute of Technology;* and *Elizabeth McHose, B. S., M. A., Director of Physical Education for Girls and Chairman of the Health Council, Senior High School, Reading, Pennsylvania.* 432 pages with 164 illustrations. The C. V. Mosby Co., St. Louis, publishers, 1941. Price $1.90.

A textbook that outlines ways of effective living. Physiology, personal hygiene, hobbies, food, etc., are all discussed in such a manner that it is interesting and understandable to the layman. It is a good book both for the young student and for the adult who wishes to know something of personal hygiene, ways of maintaining health, and how to obtain the greatest happiness in life.

BODY MECHANICS IN HEALTH AND DISEASE, by *Joel E. Goldthwait, M. D., F. A. C. S., LL. D., and other authors.* 121 illustrations, 316 pages, third edition, completely revised and reset. J. B. Lippincott Co., Philadelphia Pa., publishers. Price $5.

In the third edition of this splendid work, a number of chapters have been rewritten and others have been added. The illustrations have been improved and a new chapter on "The Heart and Circulation As Related To Body Mechanics" by Dr. William J. Kerr is excellent.

This book should be invaluable to those who are interested in chronic diseases, in the physical development of youth, or in the improvement in the body mechanics of middle life, when the so-called degenerative diseases begin to become evident. There is much to be accomplished for cases of this type and it is apparent that there must be an improvement in the general health before the specific condition can be relieved.

The chapter on "The Foot" with a description and illustrations of specific exercises will be of interest, at this time, to those of the military and naval service who are charged with the selection of candidates for training.

Dr. Goldthwait has long been an exponent of proper physical training and body mechanics with special reference to the role played in health and disease. With this broad concept of the basic

principles involved, new hope should be given to both the physician and patient who are confronted with those conditions which may be improved by proper body mechanics and exercise.

A TEXTBOOK OF MEDICINE, by American Authors, edited by *Russell L. Cecil, A. B., M. D., Sc. D., Professor of Clinical Medicine, Cornell University Medical College, and Foster Kennedy, M. D., F. R. S. E., Professor of Clinical Neurology, Cornell University Medical College.* Fifth edition, revised and entirely reset, 1,744 pages, illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1940. Price $9.50.

The numerous recent advances in the field of medicine makes it impracticable for one individual or even a small group of contributors to write an authoritative comprehensive textbook of medicine. One hundred and forty-four writers have contributed to this textbook, the majority of whom are teachers in medical schools or have carried on special investigations of the subject upon which they have written. There is far less overlapping of subjects and fewer contradictory statements than one would expect in any book written by a large number of contributors.

The subject matter of previous editions has not only been thoroughly revised but considerable new material has been added, such as equine encephalomyelitis, moniliasis, toxoplasmosis, disseminated lupus erythematosus, chronic bromide poisoning, uveoparotid fever, regional ileitis, amaurotic family idiocy and gargoylism. It does seem singular that no mention is made of giardiasis and histoplasmosis.

The reviewer considers this comprehensive authoritative book the best single volume textbook of medicine, and it is ideally suited for the general physicians and medical students.

THE DIVISION OF PREVENTIVE MEDICINE

Captain C. S. Stephenson, Medical Corps, United States Navy, in charge

TOXIC EFFECTS OF ARSENICAL COMPOUNDS

AS EMPLOYED IN THE TREATMENT OF DISEASES IN THE UNITED STATES NAVY, 1940

By Captain C. S. Stephenson, Medical Corps, United States Navy, Chief Pharmacist's Mate W. M. Chambers, United States Navy, and Mrs. Laura T. Anderson, Junior Administrative Assistant, Bureau of Medicine and Surgery.

Since November 1924 medical officers of the Navy have been required to make monthly reports of the number of doses of arsenicals administered and a separate report of each case in which ill effects are noted. During the 16 years, 1925–40, in which this information has been compiled, 1,686,710 doses of arsenicals have been administered and 1,096 reactions have been reported.

Previous articles dealing with the information obtained from these reports have been published in the following issues of this BULLETIN:

September 1925.	October 1933.	January 1937.	January 1940.
January 1927.	October 1934.	October 1937.	October 1940.
January 1929.	January 1935.	January 1938.	January 1941.
July 1930.	October 1935.	October 1938.	October 1941.
October 1931.	January 1936.	January 1939.	
October 1932.	October 1936.	October 1939.	

Cases of arsenical dermatitis occurring during the year 1940 were published in the October 1941 issue.

The present article includes all cases, except arsenical dermatitis, which were reported during the year 1940. Comparative figures from the experience of previous years are also presented.

TABLE 1.—*Arsenical reactions, 1940*

Classification	Neoarsphenamine and mapharsen			
	Mild	Severe	Fatal	Total
Arsenical dermatitis [1]	9	9	0	18
Vasomotor phenomena	5	1	0	6
Liver damage	1	2	0	3
Blood dyscrasias	1	1	0	2
Jarisch Herxheimer	1	0	0	1
Gastro-intestinal	0	1	0	1
Acute renal damage	1	0	0	1
Classification undetermined [2]	0	0	1	1
Total	18	14	1	33

[1] Case histories were published in the October 1941 number of the BULLETIN. 14 of the above reactions (10 mild, 4 severe) were caused by mapharsen.
[2] The fatal reaction occurred in a supernumerary (Samoan child) during treatment for yaws.

TABLE 2.—*Arsenicals administered during the year 1940 for all diseases*

Drug	Doses (grams)				
	0.9 to 3	0.9	0.6 to 0.9	Less than 0.6	Total
Bismarsen:					
Navy	0	0	0	213	213
All others	0	0	0	388	388
Mapharsen:					
Navy	0	0	0	73,828	73,828
All others	0	0	0	7,583	7,583
Neoarsphenamine:					
Navy	0	116	13,725	8,985	22,826
All others	0	187	2,266	11,697	14,150
Sulfarsphenamine:					
Navy	0	0	23	48	71
All others	0	0	5	776	781
Tryparsamide:					
Navy	3,076	0	0	0	3,076
All others	1,529	0	0	0	1,529
Total	4,605	303	16,019	103,518	124,445

TABLE 3.—*Arsenicals administered during the 9-year period, 1932–40, for all diseases*

Drug	Doses (grams)				
	0.9 to 3	0.9	0.6 to 0.9	Less than 0.6	Total
Acetarsone:					
Navy	0	0	0	166	166
All others	0	0	76	729	805
Arsphenamine:					
Navy	0	0	149	10,297	10,446
All others	0	0	7	706	713
Bismarsen:					
Navy	0	0	0	1,975	1,975
All others	0	0	1	1,471	1,472
Mapharsen: [1]					
Navy	0	0	0	181,438	181,438
All others	0	0	0	21,661	21,661
Neoarsphenamine:					
Navy	0	5,236	288,064	378,107	671,407
All others	0	817	37,980	133,129	171,926
Silver arsphenamine:					
Navy	0	0	0	350	350
All others	0	0	0	204	204
Sulfarsphenamine:					
Navy	0	18	334	7,472	7,824
All others	0	7	295	13,043	13,345
Tryparsamide:					
Navy	32,507	0	0	13	32,520
All others	15,518	0	2	8	15,528
Total	48,025	6,078	326,908	750,769	1,131,780

[1] First administered in 1935.

TABLE 4.—*Deaths and severe reactions, following administration of 1,338,889 doses of neoarsphenamine, 1925–40; ratio of deaths and severe reactions to doses*

Classification	Deaths		Severe reactions		Deaths and severe reactions	
	Number	Ratio to doses, 1 to—	Number	Ratio to doses, 1 to—	Number	Ratio to doses, 1 to—
Hemorrhagic encephalitis	16	83, 681	1	1, 338, 889	17	78, 758
Arsenical dermatitis	13	102, 991	199	6, 728	212	6, 316
Vasomotor phenomena	6	223, 148	57	23, 489	63	21, 252
Blood dyscrasias	8	167, 361	20	66, 944	28	47, 817
Acute renal damage	2	669, 445	5	267, 778	7	191, 270
Acute yellow atrophy of the liver	2	669, 445	0	----------	2	669, 445
Vascular damage (probable renal hemorrhage)	1	1, 338, 889	0	----------	1	1, 338, 889
Liver damage	1	1, 338, 889	23	58, 213	24	55, 787
Jarisch-Herxheimer	0	----------	2	669, 445	2	669, 445
Gastro-intestinal	0	----------	4	334, 722	4	334, 722
Polyneuritis	0	----------	1	1, 338, 889	1	1, 338, 889
Border-line hemorrhagic encephalitis	0	----------	1	1, 338, 889	1	1, 338, 889
Arsenical neuritis	0	----------	1	1, 338, 889	1	1, 338, 889
Optic neuritis	0	----------	1	1, 338, 889	1	1, 338, 889
Classification undetermined	1	1, 338, 889	0	----------	1	1, 338, 889
Total	50	26, 778	315	4, 250	365	3, 668

TABLE 5.—*Deaths following administration of arsenical compounds, 1919–40*

Year	Arsphenamine	Neoarsphenamine	Total	Year	Arsphenamine	Neoarsphenamine	Total
1919	3	0	3	1931	0	0	0
1920	1	1	2	1932	0	4	4
1921	3	1	4	1933	0	7	7
1922	0	4	4	1934	0	3	3
1923	0	1	1	1935	0	2	2
1924	1	2	3	1936	0	3	3
1925	0	2	2	1937	0	1	1
1926	0	4	4	1938	0	3	3
1927	1	4	5	1939	0	4	4
1928	0	6	6	1940	0	1	1
1929	0	3	3				
1930	0	3	3	Total	9	59	68

NUMBER OF PERSONS TREATED FOR SYPHILIS AND OTHER DISEASES

Annually on December 31 each activity reports to the Bureau of Medicine and Surgery, on NMS—Form A, the number of persons in that command who have a history of syphilis, and the number of those in the command who were treated during the year with an arsenical compound, heavy metal, or other antiluetic treatment. A report of the number of persons who were treated during the year with an arsenical compound for a disease other than syphilis is also required. This census does not take into account individuals who left the service during the year.

In the following table, treatment data are listed separately for "active service personnel" and "all others." The term "all others" includes Veterans' Administration patients, dependents of naval personnel, retired naval personnel, and native populations of insular possessions.

TABLE 6.—*Syphilis and arsenicals, U. S. Navy, 1940*

Item	Persons		
	Navy and Marine Corps	All others	Total
Strength, Dec. 31, 1940	261,374	....	261,374
Syphilis census, Dec. 31, 1940	16,614	....	16,614
Number of persons treated for syphilis with—			
Arsenicals:			
Bismarsen	18	50	68
Mapharsen	4,474	591	5,065
Neoarsphenamine	1,446	430	1,876
Sulfarsphenamine	6	91	97
Tryparsamide	182	229	411
Total persons treated with arsenicals	6,126	1,391	7,517
Heavy metal compounds:			
Bismuth	4,837	773	5,610
Mercury	18	20	38
Mixed treatment (specific mixture, etc.)	25	0	25
Potassium iodide	77	5	82
Total persons treated with heavy metal compounds	4,957	798	5,755
Number of persons treated for disease other than syphilis with—			
Arsenicals:			
Mapharsen	134	2	136
Neoarsphenamine	140	515	655
Sulfarsphenamine	0	35	35
Tryparsamide	0	1	1
Fowler's solution	28	0	28
Total persons treated with arsenicals	302	553	855
Heavy metal compounds:			
Bismuth	1	201	202
Specific mixture	1	0	1
Total persons treated with heavy metal compounds	2	201	203

In table 6 it will be noted that 302 persons in the Navy and Marine Corps were treated with arsenical compounds during the year 1940 for diseases other than syphilis. These diseases were: angina, Vincent's 204; acne, 6; gingivitis, 50; yaws, 1; and other diseases and conditions, 41.

Of the 553 persons in the group "all others" treated for diseases other than syphilis, 550 were treated for yaws and 3 for other diseases and conditions.

VASOMOTOR PHENOMENA

NEOARSPHENAMINE

(*19—1940*).—After exposure to infection on January 6, 1940, this patient developed penile lesions which were positive for *Treponema pallidum*. A Kahn blood test was 4-plus.

From January 22 to March 4, 1940, he received 7 injections of neoarsphenamine, a total of 3.25 grams, and 6 injections of bismuth subsalicylate, a total of 0.78 gram, as concurrent treatment.

The second course of arsenical treatment began with a 0.3 gram injection of neoarsphenamine on June 5, 1940, followed by a 0.45 gram injection on June 12, a 0.6 gram injection on June 19, and 0.5 gram injections on June 26, July 3, and 10, a total of 2.85 grams.

Five hours after the last injection of neoarsphenamine the patient had chills and fever and complained of feeling "poorly." After admission to the sick list he had an involuntary bowel movement and vomited.

The patient had had numerous minor reactions following previous injections of neoarsphenamine, most of them being of minor Herxheimer type. It is felt that these minor reactions were caused by the individual's sensitivity to neoarsphenamine. No specific treatment was given for this reaction. All symptoms subsided and recovery occurred the day after admission with no clinical signs of damage to the patient's health.

(20—1940).—This patient was given a diagnosis of syphilis on April 19, 1938, because of a 4-plus Kahn blood test and a maculopapular rash. From April 19, 1938, to October 4, 1939, he received 32 injections of neoarsphenamine, a total of 16.40 grams, and 50 injections of bismuth salicylate as concurrent treatment.

The fifth course of arsenical treatment began on January 2, 1940, with a 0.3 gram injection of neoarsphenamine, followed by a 0.45 gram injection on January 9, and a 0.6 gram injection on January 16. Fifteen minutes after the last injection of neoarsphenamine the patient complained of feverishness, weakness, and nausea. Temperature 101° F.; pulse 100. There was slight cyanosis of the lips. The patient had eaten a heavy meal before the injection, and stated that he ate some additional food after the injection.

He was given a 1-gram injection of sodium thiosulphate intravenously. Recovery in 2 days.

(21—1940).—After exposure to infection on February 2, 1940, this patient developed a small ovoid lesion on the upper middle portion of the shaft of the penis. The lesion was slightly indurated and mildly tender, and spread rapidly to approximately 2 centimeters in diameter.

Daily darkfield examinations from February 11 to February 20, inclusive, failed to reveal spirochetes. A Kahn blood test on February 18 was negative. On March 8 a generalized macular rash was noted on the body with an inguinal adenopathy, and on March 9 a Kahn blood test was strongly positive.

Arsenical treatment began with a 0.3 gram injection of neoarsphenamine on March 13, 1940, followed by 0.45 gram injections on March 17, 21, 28, April 3, 11, 18, and 24.

Three and one-half hours after the last injection the patient complained of chills, pain over the lower sacrum and lower lumbar region, nausea, and vomiting. The vomitus contained a large quantity of bile and there was also present a fair amount of cereal which the patient had eaten for breakfast. The temperature was 101.6° F. and rose to 103° F. within 2 hours.

The patient was put to bed with an ice cap over the epigastrium, and given forced fluids. Atropine sulphate, 1/100 grain, was given hypodermically. Complete recovery occurred in 8 hours from onset of symptoms.

MAPHARSEN

(22—1940).—One month after exposure to infection on December 2, 1939, this patient developed a penile lesion which was positive for *Treponema pallidum*.

Arsenical treatment began on January 12, 1940, with a 0.03 gram injection of mapharsen. Four hours after the injection the patient developed headache, chills, and fever. Temperature 103° F. The urine was negative for albumin. He was given 1 gram of sodium thiosulphate intravenously. Recovery occurred in 1 day.

(23—1940).—After exposure to infection, this patient developed a penile lesion. A darkfield examination was positive for *Treponema pallidum*.

From April 5 to April 23, 1940, he received 4 injections of mapharsen, a total of 0.21 grams. Each injection was followed by nausea, vomiting, chills, and fever. Bismuth subsalicylate was given as concurrent treatment.

On July 31 the patient received a 0.03 gram injection of mapharsen, and was immediately placed under observation because of apparent sensitivity to arsenicals.

One hour after the injection the patient developed nausea, vomiting, headache, and general weakness with gradual elevation of temperature and increased pulse rate. Six hours after the injection there was less nausea; temperature 102° F.; pulse, 130; and respirations, 24.

The patient was returned to duty 5 days after onset of symptoms with the recommendation that arsenicals be avoided and that treatment continue with bismuth.

(*24—1940*).—After exposure to infection, this patient developed a chancre extra-genital in suprapublic area and a faint pink rash over the entire body. A darkfield examination was positive for *Treponema pallidum*. A Kahn blood test was 4-plus.

From April 16 to April 23, 1940, he was given 3 injections of neoarsphenamine, a total of 1.5 grams. A severe reaction followed the last injection, characterized by a sharp rise in temperature, generalized rash, nausea, and vomiting. Diarrhea and an increased icterus index persisted for several days.

The patient was returned to duty in 29 days with recommendation for continuation of antiluetic treatment. Subsequent antiluetic treatment was limited to 9 injections of a bismuth preparation. (See case 25, 1940.) After consultation, it was decided to attempt treament with a small dose of mapharsen. Four hours after a 0.03 gram injection of mapharsen, the patient had general malaise, nausea, and vomiting. Temperature was 101° F. 6 hours after the injection.

The patient appeared acutely ill. There was moderate injection of the conjunctival vessels. Icterus index, 11. The patient was given bed rest, forced fluids, and high carbohydrate food intake.

July 26: Laboratory findings: WBC, 7,900; RBC, 4,830,000; hgb, 90 percent; bands, 10; segs, 83; lymphs, 5; eosins, 3. Urine, negative for occult blood.

July 31: WBC, 7,900; RBC, 4,830,000; hgb, 95 percent; bands, 2; segs, 47; lymphs, 42; monos, 2; eosins, 4; basos, 3.

The patient gradually improved under treatment and recovery was complete 32 days after onset of symptoms.

GASTRO-INTESTINAL

NEOARSPHENAMINE

(*25—1940*).—After exposure to infection on February 15, 1940, this patient developed a chancre extra-genital in the suprapubic area. A darkfield examination of the lesion was positive for *Treponema pallidum*. A Kahn blood test was 4-plus. A faint pink rash was present over the entire body.

From April 16 to April 23, 1940, he received three injections of neoarsphenamine, a total of 1.5 grams. Three hours after the last injection, the patient became nauseated and an urticarial rash appeared over the arms and legs. Diarrhea and an increased icterus index persisted for several days.

Three injections of sodium thiosulphate were given intravenously. The rash disappeared in 1 day and the other symptoms subsided gradually. Antiluetic treatment was continued with a bismuth preparation. Recovery in 29 days.

Jarisch-Herxheimer

MAPHARSEN

(26—1940).—After exposure to infection on March 1, 1940, this patient developed an indurated lesion within the meatus of the urethra. Syphilis was diagnosed by positive darkfield examinations, and 4-plus Kahn blood tests.

Arsenical treatment began May 2, 1940, with a 0.03 gram injection of mapharsen. Three hours after the injection, the patient developed a Herxheimer reaction manifested by a fever of 103° F., accompanied by a blotching of the skin. There was no nausea, vomiting, or diarrhea.

One gram of sodium thiosulphate was administered intravenously. The symptoms disappeared rapidly and recovery occurred in 3 hours.

Liver Damage

NEOARSPHENAMINE

(27—1940).—Twelve days after exposure to infection on September 14, 1940, this patient developed phimosis. There was no dysuria or urethral discharge. A darkfield examination of the penile ulcerations was negative. Tonsils were markedly enlarged, dorsal surface of penis adjacent to glands was swollen, and prostate was moderately swollen.

September 26: Sulfathiazole treatment instituted.

September 27: Sulfathiazole discontinued. No gonococci in smear.

September 28: Bilateral slit. Darkfield negative on ulcers beneath the foreskin.

October 25: Circumcised. 1 percent procaine.

November 8: Kahn blood test 4-plus. Faint macular rash on face and in groins.

November 12: A 0.3 gram injection of neoarsphenamine administered. Patient experienced a feeling of malaise following this injection.

November 19: A 0.6 gram injection of neoarsphenamine administered. Three hours later the patient felt nauseated and was put to bed on a liquid diet.

November 23: One gram of sodium thiosulphate administered intravenously. Fever 102° F. Puffiness under the eyes and a dusky redness of the skin evident in spite of pigmentation.

November 27: Temperature subsiding. WBC, 11,000; bands, 18, segs, 64; lymphs, 16; monos, 2; RBC, 4,800,000; hgb, 15 grams. Van den Bergh, direct reaction, negative. Quantitative, 0.3 mg bilirubin per 100 cc. of serum.

December 7: Patient feels much better but shows more pronounced icterus. Icterus index 61. Van den Bergh, direct reaction, immediate reaction. Indirect quantitative, 9.2 mg, bilirubin per 100 cc.

December 14: Jaundice subsiding. Gained 5 pounds. Appetite good. On high caloric diet.

January 2, 1941: Icterus index 5.2. Up and about. On regular diet. Bismuth injections begun.

January 27: Icterus 9.5 Some hemolysis which interferes with reading test. Patient has no symptoms.

February 8: Icterus index 6. No symptoms.

Six injections of bismuth salicylate have been administered.

Recovery considered complete in 77 days.

(28–1940).—After exposure to infection on June 17, 1940, this patient developed a penile lesion which was positive for *Treponema pallidum*.

Arsenical treatment began with 0.3 gram injections of neoarsphenamine on July 16 and 17, 1940. He was given two intramuscular injections of bismuth subsalicylate as concurrent treatment. Twenty-four hours after the last injection of neoarsphenamine, the patient developed a temperature of 101° F. and a rash on anterior surface of forearms. Examination revealed a thin maculopapular rash over body and extremities. The lesions disappear on pressure.

July 25: No enlargement of liver. Temperature, 102° F., pulse, 100; respirations, 20. Complains of headache. Arms and trunk present large areas of a fast-spreading rash. Forced fluids and carbohydrates.

July 27: The character of the rash has changed. Large areas of erythematous rash evident except on palms and soles.

July 29: RBC, 2,980,000. Icterus index 14. Complains of vomiting after eating. Rash clearing.

July 30: There is a slight icteric tinge to the skin but no rash. There are several small areas of subconjunctival hemorrhage in both eyes.

July 31: Vomited in the morning after eating soft boiled egg. Fever gradually subsiding, but some afternoon elevation persists. The patient states that he feels all right except for "heavy feeling about stomach." Hgb, 85 percent; RBC, 3,960,000. Icterus index 12. Patient is constipated. Given two tablets of thiamin chloride t. i. d.—p. c., sodium bicarbonate with meals. SS enema. Blood pressure 122/80.

August 2: RBC, 4,590,000. Complains of stomach feeling "heavy." Dilute HCl, 30 drops in glass of water given with meals.

August 3: No vomiting. Stomach discomfort is subsiding. Feels better. Jaundice increasing.

August 6: No vomiting for 3 days. Feels well. Jaundice clearing.

August 13: Slight icteric tinge to eyes. Desires to return to duty.

Recovery in 19 days.

MAPHARSEN

(29-1940).—This patient was exposed to infection a number of times during the month of October 1939 through contact with a person known to be syphilitic. A darkfield examination of two small ulcerated lesions on the coronal sulcus of the penis was positive for *Treponema pallidum*. Kahn blood tests were negative.

From November 28, 1939, to February 6, 1940, he received 11 injections of mapharsen, a total of 0.63 gram, and from November 27, 1939, to April 18, 1940, 20 injections of bismuth subsalicylate, a total of 2.73 grams.

The second course of arsenical treatment began with a 0.03 gram injection of mapharsen on April 9, 1940, followed by 0.06 gram injections on April 16, 23, May 7, 14, and 21.

Seven days after the last injection, the patient reported to the sick bay complaining of nausea and anorexia. Physical examination revealed a slight yellowish tinge to the skin, yellow coloration of the sclera, and slight tenderness over the liver area. No liver enlargement noted. RBC, 4,116,000; WBC 8,050; hgb, 90 percent; bands, 5; segs, 60; lymphs, 28; eosins, 1. Icterus index 27. Urinalysis: clear; dark amber; acid reaction; specific gravity, 1.012; white blood cells, few occasional clumps; weakly positive for bile.

Treatment for this condition consisted of nine 1-gram injections of sodium thiosulphate intravenously, and a high carbohydrate, low fat diet. Recovery in 11 days from onset of symptoms.

Blood Dyscrasias

NEOARSPHENAMINE

(*30-1940*).—After exposure to infection on September 18, 1939, this patient was given a diagnosis of syphilis because of the appearance of an ulcer on the foreskin on October 5, and a positive 4-plus Kahn blood test on October 6.

From October 11 to December 20, 1939, he received ten injections of neoarsphenamine, a total of 4.50 grams, and from October 12, 1939, to March 19, 1940, ten injections of a bismuth compound, a total of 1.30 grams.

The third course of arsenical treatment began on March 27 with an 0.8 gram injection of neoarsphenamine, followed by 0.8 gram injections on April 2, 9, 16, and 25, a total of 4.0 grams.

On April 25, the day of the fifth injection, the patient reported that he expectorated blood about 6 hours after the injection. A physical examination was negative at that time. He was instructed to report the next day at which time an examination showed several purpuric spots on the tongue, and buccal mucosa. WBC, 6,000; segs, 60; lymphs, 32; bands, 5; eosins, 1; monos, 1.

Coagulation time 5½ minutes; bleeding time 20 minutes; platelet count 85,000. Urine was negative for red blood cells. The patient was given two 1-gram injections of sodium thiosulphate intravenously.

On May 2, the platelet count was 217,000; bleeding time 4 minutes; and coagulation time 3 minutes. The purpuric spots in the mouth had disappeared. Recovery was considered complete in 7 days.

(*31-1940*).—After exposure to infection on May 25, 1940, this patient developed penile lesions which were positive for *Treponema pallidum*. A Kahn blood test was negative.

Arsenical treatment began with a 0.3 gram injection of neoarsphenamine on June 19 and 22, followed by a 0.45 gram injection on June 25 and 0.6 gram injections on July 2 and 9.

Unreported headache and nausea with vomiting was experienced following the injection on July 2. Twenty-four hours after the injection on July 9 these symptoms recurred in greater severity. The temperature range was 103° F. to 105° F. for 5 days. Other symptoms noted were rapid pulse; headache; nausea; vomiting; abdominal discomfort; delirium at times; icteric tinge of conjunctiva; edema of left lower lid. Discrete and widely separated vesicular lesions were uniformly pustular on forehead, nose, face, shoulder, and buttocks. Slight cough with slight soreness of throat developed 4 days after the last injection. The liver was slightly enlarged.

July 10: Urine positive for bile. WBC, 3,300; RBC 4,000,000; lymphs, 70; polys, 30. Vacuolization of red cells. Malaria smear negative.

July 12: Smear of skin lesions was positive for staphylococci.

Blood picture

Date	RBC	WBC	Polys.	Lymphs.	Monos.	Eosins.
July 10, 1940	4,000,000	3,300	30	70		
July 11, 1940	4,400,000	2,450	20	80		
July 12, 1940	4,440,000	2,600	35	65		
July 13, 1940		3,450	49	48	2	1
July 14, 1940	3,700,000	5,000	51	49		

The patient received 4 one-gram injections of sodium thiosulphate intravenously, and 200 cc. of blood by transfusion.

July 14: The patient was transferred to Wuhu General Hospital, Wuhu, China, where he received two 200 cc. blood transfusions, and 1 gram of sulfapyradine orally, t.i.d. He also received 3 grams of sulfapyridine intramuscularly. The patient fell out of a third floor hospital window sustaining fatal injuries; therefore, it was impossible to determine the results of the treatment.

Acute Renal Damage

NEOARSPHENAMINE

(*32—1940*).—Three weeks after exposure on January 7, 1939, this patient was given a diagnosis of syphilis because of a positive darkfield examination.

From January 29, 1939, to March 12, 1940, he received 16.40 grams of neoarsphenamine (number of injections not recorded), and 9.86 grams of a bismuth compound as concurrent treatment.

The course of treatment during which the reaction occurred began with a 0.3 gram injection of neoarsphenamine on February 27, 1940, followed by a 0.45 gram injection on March 5, and a 0.6 gram injection on March 12. Immediately after the last injection the patient developed nausea and vomiting; generalized erythema; gingival hemorrhages; and hematuria. Urinalysis: Appearance, dark reddish wine; reaction, acid; specific gravity, 1.036; albumin, positive (more than 100 mg.); sugar, negative; special, grossly blood (4-plus); erythrocytes, loaded. Blood: RBC, 4,110,000; WBC, 16,550; juvs, 1; bands, 14; segs, 75; lymphs, 6; eosins, 1; monos, 2.

The patient was given 1 gram of sodium thiosulphate intravenously on March 12 and 1 gram by mouth on March 13. Recovery in 3 days.

Fatal Reaction

NEOARSPHENAMINE

(*33—1940*).—The source of infection in this case is unknown. The patient (supernumerary, Samoan child) was given a diagnosis of yaws following the appearance of typical early yaws lesions on the arms and legs.

Arsenical treatment began with 0.4 gram injections of neoarsphenamine on May 15 and 22, and a 0.2 gram injection on May 29, 1940. No concurrent treatment was administered.

At 10:45 a. m., or one and one-half hours after the last injection, the patient was admitted to the Samoan Hospital. A 0.5 gram injection of sodium thiosulphate was administered intravenously and hot water bottles were applied for external heat. At 11:04 a. m. ½ cc. of adrenalin was administered subcutaneously. The patient failed to recover and died at 11:05, May 29.

The type of reaction was not determined because when seen by a medical officer the patient was unconscious and could not be aroused. Permission for an autopsy was not granted.

A TEN-YEAR STUDY OF GONORRHEA IN THE UNITED STATES NAVY[1]

By Lieutenant F. R. Lang, Medical Corps, United States Navy

PART I

INTRODUCTION

The object of this study is to determine the part played by the type of duty; the geographical location of the duty; the type of ship; the occupation, age, length of service, and race, in the epidemiology of acute gonococcus infection of the urethra as it occurs in the United States Navy.

The 10-year period 1929–38 was chosen as the study period because it was believed that: (1) a 10-year period would provide ample incidence and population figures of sufficient size to be statistically significant; (2) this particular period (1929–38) would provide the most recent 10-year-period data, and (3) insofar as can be determined this period is the most nearly standardized 10-year period of modern peacetime naval activity. The influence of the World War of 1917–18 and its aftermath may be considered as having been reduced to a minimum in the Navy about 1923-24. The present European War, beginning in September of 1939, resulted in the establishment of a limited emergency with an immediate disruption of peacetime activities, and a prompt expansion of the United States Navy. Hence, it was decided to select the 10-year period preceding and including 1938 as the study period. It is true that the period selected encompasses the depression of 1929, and the years of economic readjustment which followed. The possible effect which this may have had upon the study will be discussed later.

The study group comprises the entire personnel of the United States Navy, during the years 1929 to 1938, inclusive. Since the United States Marine Corps is an integral part of the United States Navy, its personnel is also included.

This subject was selected for analysis and study because: (a) It was hoped that some as yet undiscovered factors might be revealed which might prove valuable for use in the venereal disease control program of the Navy, and (b) there is definite and urgent need for reference data on the epidemiological factors relating to gonorrhea as it occurs in the United States Navy.

This research covers a biological study of 1,186,558 person-years of experience in the United States Navy, and deals with a total of

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[1] A condensation of a research and thesis approved by the officer in charge of Division of Preventive Medicine to fulfill the requirements for the degree of Doctor of Public Health, Johns Hopkins University.

71,915 new cases of gonorrhea. Relapses, recurrences, complications, and treatment are not included.

It was considered to be of greater epidemiological value to limit the study to new infections of acute gonococcal infection of the anterior urethra in order to standardize the basic conditions and thereby reduce as much as possible the variables, which naturally enter into an investigation of this type. To include all gonorrheal morbidity would broaden the study to cover complications, recurrences, and relapses, and it is believed that inclusion of such factors, with their innumerable variables, would tend further to complicate rather than to simplify the epidemiology of the study.

TABLE 1.—*Standing of gonorrhea in table of morbidity, U. S. Navy*

Year	Order of frequency in causes of admission	Percent of total admissions	Standing based on sick days	Percent of total sick days	Annual admission rate per 1,000
1938	2	15.31	1	6.05	52.15
1937	2	11.75	2	5.30	43.49
1936	2	11.24	2	6.16	43.41
1935	2	13.03	1	5.63	50.89
1934	2	12.10	1	5.54	55.25
1933	2	15.78	1	6.60	64.93
1932	2	16.26	1	6.83	80.16
1931	2	15.28	1	7.42	76.53
1930	1	15.86	1	6.72	72.52
1929	2	15.01	1	6.52	73.06
1928	2	13.44	2	5.76	70.94
1927	2	13.11	1	6.05	70.21
1926	1	14.96	1	6.26	69.63
1925	1	16.79	1	6.54	77.50
1924	1	17.12	1	9.60	84.94
1923	1	14.22	1	9.11	78.43

The significance of gonorrhea as a leading cause of morbidity in the United States Navy cannot be overemphasized. Table 1 illustrates some important facts pertaining to this disease. It is seen in this table that during the 16-year period, from the close of the first World War period until the time of the onset of the present war, and its resultant emergency, this disease ranked either second or first among the leading causes for admission to the sick list in the United States Navy. In the same period gonorrheal infections occupied either first or second place among the leading causes responsible for total sick days each year.

Tables 2 and 3 give a comprehensive picture of all phases of the gonorrheal problem during the 10-year period. They include, in addition to the basic data of this research, additional information pertaining to gonorrhea during the study period which will be of value for reference purposes.

Table 2 indicates that gonorrhea ranged annually between 11.24 percent and 16.26 percent of the total diseases in the entire Navy during this period. In this table the total number of cases and the total sick days for all forms of gonorrheal infection are included.

TABLE 2.—*10-year analysis gonococcus infection of urethra, U. S. Navy*

Year	Average strength	New admissions (1205)	New admissions, rate per 100,000	Percent of total diseases	Percent of class diseases	EPTE (RA)	Total cases treated	Sick days	Noneffective ratio per 100,000	Sick days per case	DD	Death rate per 100,000	EPTE (18)
1929	117,388	8,576	7,305.69	15.007	57.29	96	9,796	77,051	179.84	7.9	0	0	44
1930	117,453	8,518	7,252.28	15.865	54.16	57	9,775	76,290	177.96	7.8	0	0	24
1931	112,767	8,630	7,652.95	15.275	55.94	25	9,818	77,107	178.37	7.9	0	0	7
1932	110,717	8,875	8,015.94	16.26	59.99	27	9,978	67,633	167.39	6.8	0	0	9
1933	108,183	7,024	6,492.70	15.78	63.38	31	8,359	65,196	165.14	7.8	0	0	13
1934	109,383	6,043	5,524.63	12.10	61.19	57	7,302	55,818	139.77	7.6	0	0	16
1935	114,188	5,811	5,088.98	13.03	68.12	76	6,975	51,827	124.33	7.4	0	0	8
1936	124,408	5,400	4,340.56	11.24	68.27	57	6,660	60,951	133.85	9.2	0	0	7
1937	132,855	5,778	4,349.10	11.747	68.06	57	6,932	54,813	113.02	7.9	2	1.51	2
1938	139,216	7,260	5,214.92	15.305	67.33	44	8,477	60,401	118.87	7.1	0	0	12

TABLE 3.—*10-year study gonococcus infection, urethra, U. S. Navy*

Year	REM	A	ACD	RA	C	D	DD	IS	R	Continued	1205 admissions, sick days only	All "manner of taken up" sick days for 1205 only	Complications of 1205	Average strength
1929	194	8,576		932	502	8,934		144	19	199	43,865	77,051	1,211	117,388
1930	199	8,518		1,001	602	8,780		151	8	234	42,722	76,290	1,295	117,453
1931	234	8,630		929	560	8,916		144	5	193	43,176	77,107	1,492	112,767
1932	193	8,875		883	467	9,235		107	6	163	36,043	67,633	1,539	110,717
1933	163	7,024		1,141	494	7,591		75	4	195	36,292	65,198	1,431	108,183
1934	195	6,043		1,007	494	6,571		79	1	157	31,272	55,818	1,228	109,383
1935	157	5,811		931	466	6,255		62	1	191	29,557	51,827	1,314	114,188
1936	191	5,400		1,012	518	5,908		46	5	183	32,895	60,951	1,227	124,408
1937	183	5,778		914	661	6,092	2	37	1	139	32,555	54,813	1,114	132,855
1938	139	7,260		1,034	546	7,731		28		172	39,412	60,401	902	139,216
Total	1,848	71,915		9,931	5,310	76,013	2	873	50	1,826	367,779	647,087	12,763	1,186,558

DEFINITIONS

All venereal diseases are reported under their separate and individual diagnoses. The definition of a "new case" as used throughout this study refers to an acute infection of the anterior urethra with the gonococcal organism. With the exception of gonorrheal ophthalmia, and extremely rare cases arising otherwise, all other types of gonorrheal infection are considered to be complications of acute gonorrheal urethritis.

All of those cases which existed prior to enlistment (EPTE) were not included in the totals of new cases each year in this research, because, by definition, the study is confined to new cases acquired under service conditions in the United States Navy.

All C and Ra's (change of diagnosis from some other condition), when new cases and not actual readmissions, are adjusted in the coding and editing units of the statistical section of the Division of Preventive Medicine and are coded and tabulated as new cases.

In the handling of cases continued over from one year to another they are charged as an admission to the sick list only during the year in which they were admitted to the sick list.

Table 3 has been added principally to furnish reference data and to illustrate the broader aspects of the problem of gonorrhea in the Navy.

In a study problem of this type the question naturally arises of the possibility of reporting relapsing or recurring infections as new cases. The decision as to whether a gonorrheal infection of the anterior urethra is a new case or a relapse or recurrence rests with the medical officer who diagnoses and reports the case. Of necessity, no specific rules of general application can be laid down governing such a reappearance of infection because of the number of variables involved. The shorter the interval following a previous acute infection of the urethra, the more likely is the possibility of the condition being a relapse or recurrence of the previous infection rather than constituting a new infection. It is true that a certain amount of statistical error will be present because some new infections have been reported as relapses, and vice versa. However, it is felt that this error is minimal and self-compensating throughout the study.

In any study of this type the question of accuracy of diagnosis arises. Throughout the Navy, diagnosis of gonorrhea is based upon the finding of Gram negative, coffee bean-shaped intracellular diplococci in a purulent smear of urethral origin. The possibility of urethral purulent material containing nongonococcal organisms whose morphological characteristics are the same as those of the gonococcus is considered to be extremely remote. Cultures for the gonococcus are done chiefly at naval hospitals and are used principally for the establishment of diagnosis in chronic gonorrheal conditions.

GENERAL CONDITIONS

Graph 1, an arith-log graph, presents and compares illustratively the average strength, admission rate per 100,000, and noneffective ratio per 100,000 of gonorrhea for each year during the 10-year study period. It sets forth graphically several significant facts, namely: (1) That the average strength of the Navy remained fairly steady with no wide or sudden fluctuations during those peacetime years; (2) that from 1932 until 1936 there was a progressive decline in the annual admission rates; and (3) that there was a decrease in the noneffective ratio per 100,000 for gonorrhea from 1931 to 1937.

As the study progresses, it will be seen that the decline in admission rates between 1932 and 1936 is general as to distribution and is not caused by any great fluctuation within any particular subdivision, occupation, age group, length of service group, or race within the study period.

It is of interest to note that the increase in admission rates in 1937 and 1938 coincides accurately in time interval with the removal of certain punitive measures which had been enforced in connection with the venereal disease control program of the Navy. In 1926 it became a court-martial offense if a man contracted a venereal disease and could not prove he had taken chemical prophylaxis. Later, as another punitive measure of control the marks in "conduct" and "proficiency in rating" of a man who contracted a venereal disease were required to be lowered so as to preclude the possibility of his being advanced in rating for an ensuing period varying from 6 months to a year. For years concealment of venereal disease has been a court-martial offense. Furthermore, it had been ruled that an individual in the United States Navy, who was required to lose time on the sick list because of venereal disease or any other condition which was directly attributable to his own misconduct was compelled by regulation to lose his pay and time while so incapacitated. This latter measure is purely a legal one and not a venereal disease control one.

There are those who believe that the decline in annual admission rates between 1932 and 1936 was due to increased concealment of the disease. It cannot be denied that it meant more to the career of an enlisted man infected with venereal disease to try to conceal his disease and to seek treatment ashore rather than to report his case to his medical officer and thereby be subjected to a court-martial and loss of time and pay while on the sick list, and to have his chances for advancement nullified.

The more severe punitive measures were removed during the first half of 1937. Coincidently with this it will be seen in graph 1 that

the gonorrhea rate for new cases increased slightly in 1937 and to a greater extent in 1938. Time alone will indicate whether this curve will flatten off and thereby suggest that the increase occurring after 1936 is due to removal of punitive measures which tended to increase concealment. On the other hand one should not lose sight of some other factors which may have contributed to the decline between 1932 and 1936. Among these should be considered: (1) The possibility of the decline of 1932 to 1936 being part of a long-time periodic cycle of the disease. No evidence could be unearthed that such cycles occur in the United States Navy. (2) The part played by the nation-wide depression which covers practically all of the first half of the study. During the depression period there were far more applicants for enlistment in the Navy than there were vacancies, and the most desirable types of applicants could be selected. Undoubtedly this selection of higher types played some part in the decline in rates which occurred between 1932 and 1936. It is impossible on the other hand to determine how much this influenced the annual rate of new cases of gonorrhea.

Another variable which enters into the study is the concealment of new cases. It may not be denied that this does occur to some extent in the Navy during any period. It is just as impossible to determine the actual rate of concealment in the Naval service as it is to determine the contact rate of exposure to venereal disease either in a civilian group or within the Navy. However, prior to 1926 or subsequent to 1936 there should have been very little reason for attempted concealment except for the psychological and social stigmata associated with having a veneral infection. It is believed that those factors are less prevalent in the Navy than in civilian life. Furthermore, throughout the Navy periodic inspections were and are held for concealed venereal diseases. However, it must be recognized and accepted that some concealment of cases of gonorrhea does occur. There is no evidence to indicate that concealment occurs in any particular location or subdivision of the United States Navy to a greater extent than in any other. Therefore, it appears valid to assume that this uncontrolled variable is evenly distributed through the study.

The sulfonamide drugs did not come into widespread use in the treatment of gonorrhea in the Navy until 1938. To date they have not been used prophylactically. Their usage would play no part in influencing the incidence of new cases, and would be reflected only in the duration of each case, the number and percentage of complications, and total gonorrheal sick days. Hence they were not a factor which influenced this study.

Graph 1.
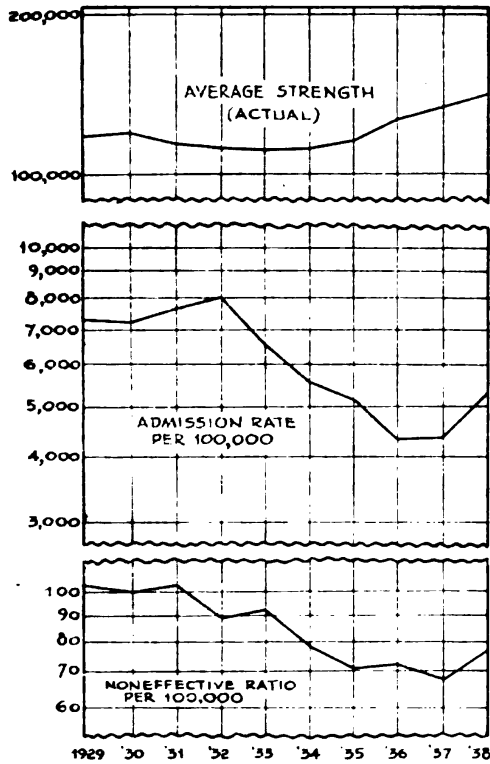
10 YEAR STUDY
GONOCOCCUS INFECTION, URETHRA - U. S. NAVY
Comparison of Average Strength,
Admission Rate & Noneffective Ratio
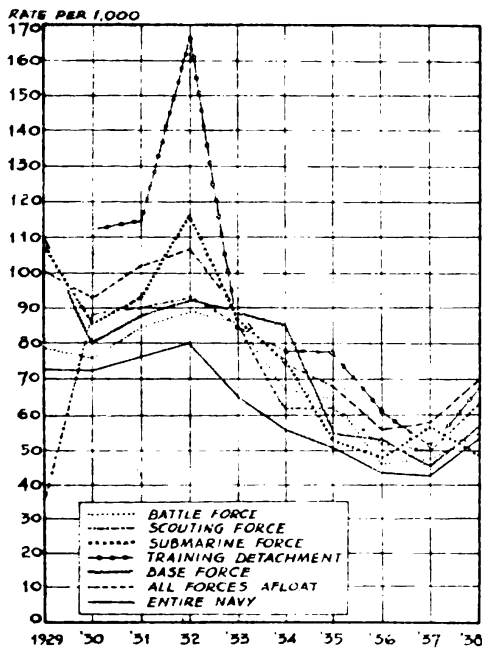
Graph 2.
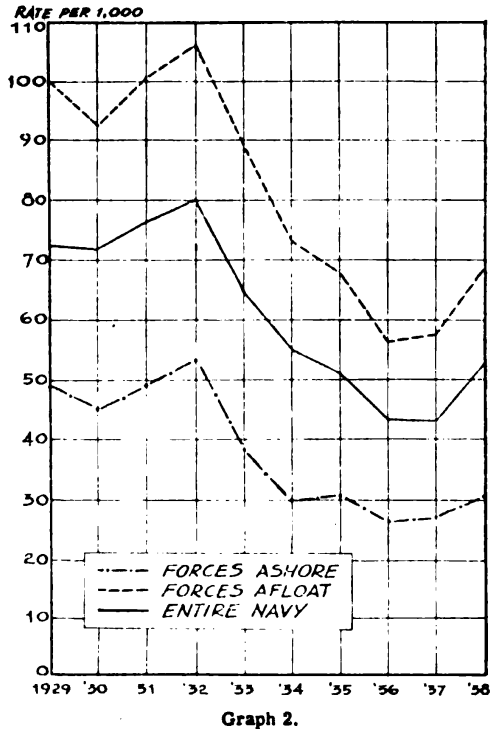
TEN-YEAR GONORRHEA STUDY - U.S. NAVY
Comparison of Rates
of Forces Afloat and Forces Ashore
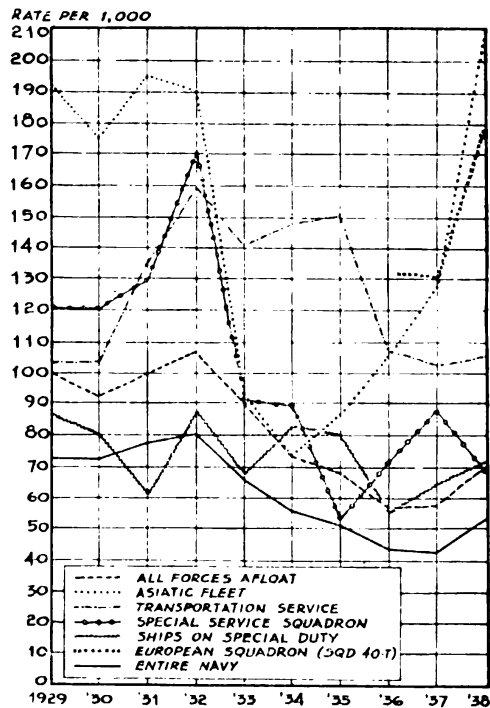
Graph 3.

TEN-YEAR GONORRHEA STUDY - U. S. NAVY
Comparison of Rates per 1,000
by Subdivisions of Forces Afloat

Graph 4.

Ten-YEAR GONORRHEA STUDY - U. S. NAVY
Comparison of Rates per 1,000
by Subdivisions of Forces Afloat

NEW ADMISSION RATES OF ALL FORCES ASHORE COMPARED WITH THOSE OF
ALL FORCES AFLOAT

Graph 2 establishes the correlation between annual rates of forces ashore and those of forces afloat. In this part of the study the gonorrheal incidence of the few naval ships and stations which were in commission during a fractional part of a year were adjusted to an annual basis.

Table 4 records the annual rates and the 10-year rate of the various major subdivisions of forces in the United States Navy. It shows that very consistently, year after year during the study period, the rates per 1,000 of the forces afloat are slightly more than double those of the forces ashore. This is shown more distinctly in graph 2.

Generally speaking, during this study period, naval personnel while on duty ashore in the continental United States were permanently situated in a given location where, as a rule, more healthful diversions were available, and married men were able to locate their families nearby. Each ship of the Navy was assigned a home port during these peacetime years, and families often lived in the local community. However, on maneuvers, tactical exercises, fleet problems, etc., naval vessels were absent from home ports for varying periods, and often put in at other ports, foreign and domestic, for recreational or other reasons.

A further breakdown of forces ashore in table 4 reveals that for the period of this study the annual rates of new cases of gonorrhea of the forces ashore within the continental limits of the United States were consistently nearly half the rates of the forces ashore outside the continental limits of the United States. More will be said about this later.

In table 4, the "new case" gonorrheal rates of forces afloat are shown according to major groupings in the United States Navy during this study period. In graphs 3 and 4 these data are presented with more clarity. Table 4 and graph 4 bring out the fact that the Asiatic Fleet, the Special Service Squadron, the European Squadron and the Naval Transportation Service had the highest rates during the time period under study.

Ships of the Asiatic Fleet spent considerable time in Chinese waters. In that part of the world, sociological, economic, and religious standards are so widely divergent from those in the United States. A different viewpoint on morals prevails and prostitution is widespread. Because the men are in a foreign country it is not always possible to provide suitable wholesome diversions during off-duty periods.

The Special Service Squadron is a unit which was located in the Caribbean area during the period of this study. In the course of each year the ships of this squadron entered a number of ports of

TABLE 4.—*10-year gonorrhea study, U. S. Navy, subdivisions of forces*

[Rates per 1,000]

	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	10-year rate
Forces ashore:											
Forces ashore, continental United States of America	39.50	36.43	43.52	41.18	33.12	28.18	29.17	23.42	23.17	24.54	31.78
Forces ashore, outside continental United States of America	77.99	69.73	66.91	84.09	51.77	34.30	37.74	39.40	43.99	56.31	57.65
All forces ashore	49.63	44.94	49.42	52.93	38.45	29.82	30.96	26.41	27.38	30.87	37.92
Forces afloat:											
Battle Fleet	79.63	76.04	85.34	89.80	84.92	68.09	64.02	47.26	47.78	54.14	67.94
Scouting Fleet	39.25	88.18	89.69	92.24	84.80	61.63	62.24	52.32	49.99	63.98	73.35
Submarines	109.54	85.25	92.47	117.39	87.53	73.92	52.82	48.72	56.46	49.10	77.09
Training detachment			114.19	167.18	85.17	77.52	78.22	60.72	50.38	67.18	72.99
Base Force	110.04	79.87	87.44	92.13	88.37	85.26	54.70	53.10	47.08	54.20	71.72
Asiatic Fleet	191.01	174.27	195.06	190.58	92.04	72.77	85.51	104.25	128.24	205.25	148.41
Naval transportation service	103.10	103.51	134.13	160.31	140.31	148.07	150.53	106.67	102.71	104.56	125.11
Special service squadron	120.10	119.89	129.37	172.08	90.51	89.43	52.39	71.52	87.46	68.75	104.76
Special duty	86.17	79.77	60.51	86.10	66.19	83.00	79.31	53.55	63.01	70.25	71.78
European squadron (Sqd. 40-T)									131.58	180.95	142.13
All forces afloat	100.04	92.36	100.44	106.59	89.06	73.12	68.21	56.06	57.28	69.28	79.82
Entire Navy	73.06	72.52	76.53	80.16	64.93	55.25	50.89	43.41	43.48	52.16	60.61

the central American countries. In most of these ports prostitution was tolerated; standards of hygiene and sanitation were extremely variable, and chiefly of a lower order, and the same difficulties existed of providing healthful entertainment and diversions for the men when off duty and away from their ships.

The European Squadron came into existence only in the last 2 years of the study (1937 and 1938). During most of that time it was based at Lisbon, Portugal, and spent part of the first year evacuating refugees. Its ships visited numerous Mediterranean ports. The "new case" gonorrhea rate of this squadron was very high during the 2-year period.

In the foreign countries with which units of the Navy made contact, naturally there was not the same degree of interest in the welfare and recreation of our Navy men, as was displayed in the United States by local, civic, religious, patriotic, veterans' and women's organizations. Furthermore, in foreign ports frequented by our ships public health standards were as a general rule not of a high order; definite venereal disease control and social hygiene programs were usually weak or entirely lacking; and the attitude of local police authorities towards prostitution was usually one of indifference or tolerance.

The Naval Transportation Service had permanently high rates during the period. Ships of this service, except for periods in dry-dock or overhaul in a navy yard, were constantly moving. They plied between numerous navy ports, including many outside the continental United States. Married members of the crews had very little time to spend with their families. They were in the various ports too short a time for their personnel to make many wholesome local social contacts.

It is significant that the two principal subdivisions of fighting ships, viz., the Battle Fleet and the Scouting Fleet, have rates very closely similar. The rates of both are low compared with those of all forces afloat. The Battle Fleet during this period was made up of battleships and destroyers and the Scouting Fleet of cruisers and destroyers. The ships of both forces were based in continental waters.

An analysis of the 10-year rates shown in table 4 indicates that in order of descending frequency the rates of acute gonococcus infection of the urethra in the major subdivisions of the United States Navy afloat ranged as follows:

Subdivision	10-year rate per 1,000	Subdivision	10-year rate per 1,000
1. Asiatic Fleet	148.41	8. Ships on special duty	71.78
2. European Squadron	1 142.13	9. Base Force	71.72
3. Naval Transportation Service	125.11	10. Battle Fleet	62.94
4. Special Service Squadron	104.76	11. Forces ashore outside continental U. S. A	57.65
5. Submarine Force	77.09		
6. Scouting Fleet	73.35	12. Forces ashore, continental U. S. A.	31.78
7. Training Detachment	72.99		

1 Derived from 2 years of experience.

It is considered significant that the Battle Fleet, one of the two major subdivisions of the fighting forces based in continental waters had a 10-year rate which was the third lowest.

"Ships on special duty" (number 8 on the list) are those which were not attached to a fleet or force and which individually performed a wide variety of missions. They include survey ships, the station ship at Guam, tugs, yard craft etc.

During the period under consideration, ships of the Base Force remained for the most part at anchor in their home ports, except during navy yard overhaul periods or the annual fleet problem, at which time they underwent a training period of from 6 to 8 weeks together with the entire fleet.

The Training Detachment during the study period was made up of several old and over-age battleships and a group of destroyers. Its function was primarily training midshipmen and reservists. Midshipmen underwent a training cruise of 6 to 8 weeks during the summer each year on two of the over-age battleships. During the remainder of the year, the battleships, and during the entire year, the destroyers, of this detachment were occupied in taking naval reservists on training cruises of approximately 2 weeks' duration.

Attention is invited in particular to the rates of the Submarine Force. (Table 4 and graph 3.) This force was made up of submarines and submarine tenders. While the Submarine Force which is grouped collectively in table 4 ranks in fifth highest place on the basis of its 10-year rate, it will be seen later in studying the rates from various types of ships that the fleet type of submarines had the lowest rates among all classes of ships. This phase will be discussed later.

A résumé of this part of the study establishes that for the 10-year period (see graph 3) : (1) The annual admission rates of forces afloat based in continental waters of the United States (Battle Fleet, Scouting Fleet, Submarine Force, Training Detachment, and Base Force), were lower than the annual rates for forces afloat outside the continental waters. (2) With the exception of the Training Detachment, these were lower than the annual rates for all forces afloat. (3) The Training Detachment averaged a higher rate among the forces based in continental waters. (4) The combined rates of all forces afloat were higher than the annual rates for the entire Navy. (5) With the exception of the Training Detachment in 1932 and 1935 and the Submarine Force in 1932, the annual rates of these various subdivisions in general show very little that is statistically significant in difference one from another. No explanation could be found for the unusually low annual rate of the Scouting Fleet in 1929.

Continuing the résumé further, it is seen in graph 4 that: (1) The annual rates of forces afloat which functioned outside the continental

U. S. A. (Asiatic Fleet, Special Service Squadron, European Squadron and Naval Transportation Services) were higher than the annual rates for all forces afloat; also they were higher than the annual rates of the entire Navy. (2) The Naval Transportation Service annual rates were consistently high. Furthermore, this latter subdivision of the forces afloat failed to show the decrease in rates which other subdivisions did between 1932 and 1937.

(To be Continued)

LETHAL DOSE OF CHLORINE FOR CERCARIAE OF SCHISTOSOMA MANSONI

By Commander Thomas B. Magath, Medical Corps, United States Naval Reserve

Schistosomiasis is so localized and restricted in its distribution in the Western Hemisphere, that most officers and men in the Navy have never encountered the disease. Yet in Puerto Rico and Vieques it is a disease of immense importance. Everyone who visits these islands should be warned not to bathe, wade, or swim in any of the fresh water streams or the water from any locality unless certain no human beings live or frequent the waters above the source of his supply. The number of persons having schistosomiasis in these islands is very large and in certain regions the majority of adults are infected; surveys made on children in these regions reveal infection rates as high as 600 per 1,000 even by unimproved methods of examination. It is not known just how many of the 1,200 streams of Puerto Rico are contaminated but for practical purposes all may be so considered. The cercariae which attack man thru his skin are developed in a common snail of Puerto Rico, *Australorbis glabratus*. These snails are common along streams there and wherever there are stream-pools.

Because Naval and Army personnel are frequently stationed on the above-mentioned islands it is necessary that they be warned of this hazard and it is important to know what water treatment is effective against these parasites. No information is available from literature, but from the nature of the organism and experiments conducted on amebic cysts it may be assumed that rapid gravity sand filters would be effective. Since in military maneuvers and even in certain stations it may not be possible to filter water for personal use, I performed certain experiments to see if chlorine was effective against these cercariae under similar conditions as used for water treatment.

Thru the kindness of Dr. Hoffman, of the School of Tropical Medicine of the University of Puerto Rico, I was furnished a suspension of cercariae of *Schistosoma mansoni*, freshly emerged from their snail hosts and a place to perform the experiments. The cercariae were very active and control cercariae continued their activity thruout the length of the experiment. This suspension was mixed with various amounts of a solution of perchloron and the amount of available chlorine calculated. The cercariae were observed thru a binocular dissecting microscope and the time recorded when they ceased to move and when all activity of their organelles stopped. Table I gives the results.

Table I.—*Experiments to test the amount of chlorine necessary to kill cercariae of Schistosoma mansoni*

Strength of chlorine (parts per million)	Time to kill	Residual chlorine (Orthotolidin) after 30 minutes	Strength of chlorine (parts per million)	Time to kill	Residual chlorine (Orthotolidin) after 30 minutes
	Minutes	*Parts per million*		*Minutes*	*Parts per million*
10.0	1	3.0	0.4	11	0.2
2.0	4	0.8	0.2	30	0.1
1.0	6	0.4			

The water used in the test was rain water and the cercariae were quite free of grass debris.

The significance of this information is that frequently in camps, drinking and bathing water are separated; the drinking water receiving more treatment than that used for bathing and washing objects. Since cercariae invade the skin, the water used for other purposes than drinking, and which might come in contact with the skin, is very important in Puerto Rico. It appears from the experiments, if water is so chlorinated that there is present 0.2 parts per million after 30 minutes exposure to chlorine, the cercariae will not only be killed but a sufficient margin of safety will be had to avoid certain biological failures and human errors inherent in water treatment.

SUMMARY

The frequently used method of requiring approximately 0.2 parts of chlorine per million of residual chlorine in water and a holding time of 30 minutes, will render water safe against pollution with cercariae of *Schistosoma mansoni*.

STATISTICS

HEALTH OF THE NAVY

The statistics (anual rates per 1,000) appearing in this summary were compiled from data contained in monthly reports of communicable diseases received in the Bureau for the months of April, May, and June 1940.

ENTIRE NAVY

Year	All diseases	Injuries and poisonings	All causes	Communicable diseases		Venereal diseases
				A	B	
1936	337	49	386	30	140	42
1937	276	36	313	18	98	59
1938	331	50	382	9	79	78
1939	339	48	387	7	85	90
1940	431	51	482	48	118	83
1941	413	47	461	47	118	51

FORCES ASHORE

1936	518	50	568	59	226	26
1937	312	36	347	34	131	27
1938	364	51	415	15	105	45
1939	332	48	380	12	104	41
1940	446	53	498	43	144	52
1941	476	48	524	72	152	36

FORCES AFLOAT

1936	229	49	278	13	89	51
1937	256	37	293	8	78	78
1938	313	50	363	5	64	96
1939	343	47	391	4	75	117
1940	420	50	470	52	99	105
1941	358	46	404	25	89	65

Common infectious diseases of the respiratory type.—During the quarter ending June 30, 1941, there were 9,326 admissions for these diseases reported for the entire Navy—5,517 from shore stations in the United States, 3,694 from forces afloat, and 115 from foreign shore stations. Catarrhal fever was responsible for 6,091 of the admissions.

Ships and shore stations reporting the greatest number of admissions were as follows:

Ship or station	April	May	June	Total
Naval Training Station, Great Lakes, Ill_____	607	421	192	1, 220
Naval Training Station, Newport, R. I_____	215	84	100	399
Marine Corps Base, San Diego, Calif_____	157	105	70	332
Naval Air Station, Jacksonville, Fla_____	146	110	51	307
Naval Training Station, San Diego, Calif_____	125	79	95	299
Naval Training Station, Norfolk, Va_____	120	97	47	264
U. S. S. *Ranger*_____	6	164	46	216
Naval Air Station, Pensacola, Fla_____	66	75	33	174
Marine Barracks, Quantico, Va_____	107	35	14	156
Naval Air Station, Norfolk, Va_____	75	43	35	153
U. S. S. *Yorktown*_____	5	121	20	146
First Marine Division, Fleet Marine Force_____	44	36	42	122
U. S. S. *New Mexico*_____	27	50	29	106
Naval Air Station, San Diego, Cal_____	40	40	24	104
Naval Air Station, Corpus Christi, Tex_____	28	25	50	103
U. S. S. *Mississippi*_____	29	45	27	101
Submarine Base, New London, Conn_____	49	33	13	95
U. S. S. *Prairie*_____	47	22	21	90
U. S. S. *California*_____	48	20	17	85
U. S. S. *West Virginia*_____	37	19	12	68
U. S. S. *Enterprise*_____	21	37	10	68
Naval Training School, Noroton, Conn_____	41	19	6	66
Marine Barracks, Parris Island, S. C_____	33	21	11	65
Receiving Ship, New York, N. Y_____	42	17	6	65
U. S. S. *North Carolina*_____	18	31	15	64

Tonsillitis, acute—U. S. S. Ranger—(Special report dated June 19, 1941).—A renascent, fulminant epidemic of acute tonsillitis involving 47 men occurred on board the U. S. S. *Ranger* on May 24, 1941, the day after conclusion of 14 days of continuous operations at sea entailing difficult work schedules with resultant fatigue. This outbreak occurred 20 days after a similar limited epidemic which involved 130 men.

The following table shows time and incidence of cases.

May 8, 1941_____	1	May 28, 1941_____	17
May 23, 1941_____	1	May 29, 1941_____	5
May 24, 1941_____	15	May 30, 1941_____	1
May 25, 1941_____	35	May 31, 1941_____	5
May 26, 1941_____	30		
May 27, 1941_____	21	Total_____	130

On May 23, 1941, the U. S. S. *Yorktown* and U. S. S. *Ranger* interchanged 3 air squadrons, a transfer of nearly 400 men from each ship. These men were physically examined prior to transfer. Concurrent with our epidemic, the U. S. S. *Yorktown* admitted a large number of men to the sick list with the same diagnosis. These men were from the newly arrived *Ranger* air group. Thus, the deduction is apparent that a large number of men were transferred while in the asymptomatic, incubative period. Investigation began at the

sources most likely to harbor the causative factor. Bacteriologic investigation was limited by inadequate culture facilities. Throat smears were not productive of specific information.

The possibility of this being a milk-borne epidemic was scouted. Milk used is made from powdered milk with water added and agitated in a special mixer. Milk was served in general mess 72 hours before this outbreak. Examination and questioning of men detailed to the task of preparing milk revealed no positive evidence. It might be added that milk used by the individual messes is prepared by its own personnel. The chief petty officer's mess, the warrant officers' mess and the wardroom mess contributed no cases to this epidemic, consistent with the fact observed in the two preceding epidemics that have occurred on board this vessel. Two mess attendants (general mess) were admitted to the sick list. Ice cream, prepared exclusively by one person and used by all messes, seemed to escape indictment. Salads are mixed with much hand contact and are a possible cause. However, no fresh salads had been served for more than a week. Obviously, the results of culture investigation would lend more weight to our conclusions.

All food handlers were examined and questioned relative to incidence of sore throats, etc. Two were removed from food handling because of signs of tonsillitis. The possibility that they were carriers was considered. The presence of tonsils was noted among 69 percent of the group, and the greater part of these stimulated suspicion.

The flaming of scuttle-butts was carried out, as is the usual routine. Water was not considered a factor since its common source and general use would have produced a generalized epidemic, whereas the cases encountered were limited to those partaking of the general mess.

Inspection of messing facilities reveals inadequate equipment for washing hands of food handlers. Facilities have now been provided in the scullery. By the nature of its construction, the helpful practice of sanding and airing wooden mess tables topside is not possible on an aircraft carrier. The tables are dusted with foxtail brushes which, in themselves, are contaminants. This latter practice has been discontinued.

The onset was sudden and accompanied with fever, sore throat, dysphagia, and general malaise. The pharynx was deeply injected and presented the picture usually termed "streptococcal throat." Tonsils were characteristically involved. There were four cases with an erythematous rash. These cases were promptly isolated and were observed for other evidence of specific disease. The usual corroborative tests diagnostic of scarlet fever were negative. Isolation was maintained, however. One man developed a peritonsillar abscess. There were no complications.

All of the men appeared more acutely ill and remained on the sick list longer than those admitted in preceding epidemics, and did not respond as quickly to therapeutic measures. Due to the severity of symptoms, sulfanilamide was included as a routine measure. Cervical adenitis appeared more often and responded slowly to treatment. Instead of becoming afebrile in 24 or 48 hours the patients showed an elevation for an average of 72 hours. It is believed that passage 'of the organism through successive humans increased the virulence.

Tonsillitis, acute—U. S. S. Yorktown—(Special report dated June 2, 1941).—An epidemic of acute tonsillitis and pharyngitis broke out among the enlisted personnel of Squadrons VS–41, VS–42, VF–41 and the flag personnel who had been transferred from the U. S. S. *Ranger* to this ship on May 23, 1941. A total of 120 men were admitted between May 23 and 28, 82 of which were admitted on May 24 and 25.

These men were apparently in the incubation period of the disease and presented no symptoms until about 12 hours after transfer. A moderately severe epidemic of tonsillitis which occurred on board the U. S. S. *Ranger* during the first part of May seemed to have subsided when the transfers were made.

No Naval aviation pilots were affected by the outbreak and the operations of the aircraft squadrons and ship were not delayed.

The cases were characterized by sudden onset, malaise, sore throat, and fever. The physical findings were similar, with an acute inflammatory reaction of the tonsils and pharynx; many cases showed small ulcerations of the tonsils and pharynx, and patches of white pseudomembrane. The temperature ranged from 99° F. to 103° F. No skin rash or significant lymphadenopathy occurred. Representative cases showed a leukocytosis ranging from 10,000 to 16,000 with a neutrophilia and a moderate shift to the left. Urinalyses were normal. Bacteriological studies were made on representative cases and staphylococcus aureus staphylococcus albus, and micrococcus catarrhalis were cultured on Löffler's media. The average duration of the disease was 4 days.

Treatment consisted of isolation of all cases in a living compartment adjacent to the Sick Bay, bed rest, and symptomatic treatment. Hospital Corpsmen were assigned to a sanitary squad to stand by the sculleries after each meal to supervise the sterilization of all mess gear. Scuttle-butts and telephone mouthpieces were washed twice daily with tincture of green soap and water. Men in the draft from the U. S. S. *Ranger* were inspected daily for symptoms of tonsillitis and positive cases were isolated.

The source of infection apparently had its origin on the U. S. S. *Ranger*, where a similar but smaller epidemic occurred three weeks

before but which had receded from epidemic proportion when the personnel transfer was made. Only one case occurred among the regular Squadron or personnel on board the U. S. S. *Yorktown*.

Other infectious diseases.—There were 488 admissions for measles, 1,762 admissions for German measles, and 1,037 admissions for mumps, during April, May, and June, 1941. Ships and shore stations reporting the greatest number of admissions were as follows:

Ship or station	German measles	Measles	Mumps
U. S. S. *Augusta*	0	3	22
U. S. S. *Argonne*	3	0	17
U. S. S. *New York*	12	2	5
U. S. S. *Omaha*	12	0	16
U. S. S. *Prairie*	21	0	0
First Marine Division, Fleet Marine Force	38	21	2
U. S. S. *Ranger*	3	0	24
U. S. S. *St. Louis*	3	0	13
U. S. S. *Saratoga*	2	6	2
U. S. S. *Sims*	5	1	3
U. S. S. *Texas*	26	2	0
U. S. S. *Tuscaloosa*	0	2	36
U. S. S. *Wasp*	0	0	11
U. S. S. *West Virginia*	17	1	0
U. S. S. *Wyoming*	29	0	0
Naval Torpedo Station, Newport, R. I.	4	6	0
Naval Training Station, Newport, R. I.	86	1	1
Submarine Base, New London, Conn.	18	1	8
Naval Reserve Radio School, Noroton, Conn.	27	0	0
Naval Hospital, Brooklyn, N. Y.	7	3	0
Naval Reserve Midshipmen's School, New York, N. Y.	30	9	0
Navy Yard, New York, N. Y.	8	1	0
Navy Yard, Philadelphia, Pa.	9	7	3
Marine Barracks, Washington, D. C.	10	2	0
Naval Academy (midshipmen), Annapolis, Md.	42	2	11
Marine Barracks, Quantico, Va.	96	3	2
Naval Air Station, Norfolk, Va.	4	1	34
Receiving Station, Norfolk, Va.	6	1	12
Naval Training Station, Norfolk, Va.	134	56	256
Marine Barracks, Parris Island, S. C.	14	21	1
Naval Air Station, Jacksonville, Fla.	59	6	26
Naval Air Station, Miami, Fla.	2	1	16
Naval Air Station, Pensacola, Fla.	60	0	6
Naval Reserve Midshipmen's School, Chicago, Ill.	26	0	1
Naval Training School (Signal), Chicago, Ill.	30	0	0
Naval Training Station, Great Lakes, Ill.	221	11	81
Marine Corps Base, San Diego, Calif.	201	12	35
Receiving Station, San Diego, Calif.	10	2	27
Naval Training Station, San Diego, Calif.	69	77	72
Naval Station, Guam	38	11	0

Septic sore throat.—A total of 50 cases of septic sore throat were reported in the Monthly Reports of Communicable Diseases for April, May, and June, 1941, 23 of which were admitted to the sick list at Naval Training School, Noroton, Conn.

Chickenpox.—Forty cases of chickenpox were reported for the entire Navy, 25 from forces afloat and 15 from forces ashore.

Scarlet fever.—Cases of scarlet fever were reported by the following activities:

Ship or station	April	May	June	Total
U. S. S. *Albemarle*	1	0	0	1
U. S. S. *Cincinnati*	1	0	0	1
U. S. S. *Harry Lee*	0	0	1	1
U. S. S. *Henderson*	1	0	0	1
U. S. S. *MacLeish*	0	1	0	1
U. S. S. *Mayrant*	0	1	0	1
U. S. S. *Milwaukee*	0	1	0	1
U. S. S. *Texas*	1	0	0	1
Naval Hospital, Newport, R. I	2	0	0	2
Naval Training Station, Newport, R. I	42	2	0	44
Submarine Base, New London, Conn	0	0	1	1
Naval Reserve Midshipmen's School, New York, N. Y	2	5	0	7
Naval Hospital, Philadelphia, Pa	0	1	0	1
Navy Yard, Washington, D. C	3	0	0	3
Marine Barracks, Quantico, Va	0	2	0	2
Naval Training Station, Norfolk, Va	14	8	1	23
Naval Reserve Midshipmen's School, Chicago, Ill	4	0	1	5
Naval Training School, Chicago, Ill	2	0	0	2
Naval Hospital, Great Lakes, Ill	0	2	0	2
Naval Training Station, Great Lakes, Ill	2	4	2	8
Naval Training Station, San Diego, Calif	1	0	2	3
Roosevelt Base, Terminal Island, Calif	2	0	0	2
Total	78	27	8	113

MORBIDITY

Summary for the quarter ending June 30, 1941

TABLE 1.—*Total, United States Navy*

	Admission rates per 1,000		
	Forces afloat	Forces ashore	Entire Navy
All causes	404. 14	523. 94	460. 62
Diseases only	357. 75	475. 73	413. 37
Injuries and poisonings	46. 39	48. 21	47. 25
Communicable disease transmissible by oral and nasal discharges (class VIII):			
(A)	24. 79	72. 17	47. 12
(B)	88. 58	151. 94	118. 45
Venereal diseases	65. 26	35. 66	51. 31

TABLE 2.—*Summary of morbidity, naval districts, for the quarter ending June 30, 1941*

District	Annual rates per 1,000			
	All causes	Diseases only	Respiratory diseases	Venereal diseases
1st Naval District	670. 47	620. 73	285. 24	20. 30
3d Naval District	565. 56	500. 33	134. 46	40. 65
4th Naval District	353. 88	308. 37	95. 09	29. 21
Activities on the Severn and Potomac Rivers	340. 40	308. 33	80. 53	17. 34
5th Naval District	658. 27	605. 70	137. 42	48. 91
6th Naval District	534. 94	474. 08	89. 41	30. 05
7th Naval District	528. 82	474. 81	155. 36	53. 17
8th Naval District	407. 27	371. 70	123. 12	32. 83
9th Naval District	1, 002. 90	950. 88	498. 08	8. 23
10th Naval District	746. 05	625. 48	126. 53	130. 11
11th Naval District	460. 10	419. 75	139. 47	27. 60
12th Naval District	380. 84	343. 15	98. 62	39. 29
13th Naval District	356. 74	314. 04	96. 77	34. 16
14th Naval District	318. 00	268. 36	68. 96	21. 96
15th Naval District	463. 87	400. 42	59. 22	25. 38
16th Naval District	528. 15	488. 29	35. 87	123. 57
Outlying stations	802. 46	744. 95	135. 57	124. 61

TABLE 3.—*Venereal diseases (class XII) and communicable diseases transmissible by oral and nasal discharges (class VIII), ships and shore stations, for the quarter ending June 30, 1941*

Ship or station	Venereal diseases (class XII)		Communicable diseases (class VIII)	
	Rate per 1,000, 2d quarter, 1941	Median rate, 2d quarter, 1936–40	Rate per 1,000, 2d quarter, 1941	Median rate, 2d quarter, 1936–40
Albemarle	46. 31	[1] 12/4/40	167. 87	[1] 12/4/40
Altair	98. 36	53. 16	131. 15	28. 57
Argonne	10. 96	66. 67	186. 30	62. 75
Arizona	27. 88	56. 29	154. 63	238. 41
Arkansas	56. 76	82. 42	148. 65	101. 08
Astoria	67. 87	62. 49	72. 40	68. 17
Augusta	44. 94	441. 96	159. 35	76. 19
Barnett	69. 28	[1] 9/25/40	157. 04	[1] 9/25/40
Battle Force, Fleet Air Detachment	26. 64	32. 97	126. 53	104. 12
Black Hawk	183. 12	417. 05	45. 78	95. 11
Boise	16. 29	[1] 8/12/38	81. 47	[1] 8/12/38
Brooklyn	36. 29	[1] 9/30/37	153. 23	[2] 9/30/37
California	27. 33	58. 95	214. 12	70. 18
Canopus	330. 83	312. 17	65. 16	140. 80
Chaumont	98. 43	194. 55	89. 49	108. 95
Chester	80. 77	45. 23	150. 00	86. 55
Chicago	26. 17	50. 84	56. 07	84. 74
Cincinnati	156. 75	48. 98	168. 36	51. 50
Colorado	13. 03	83. 93	70. 36	86. 02
Concord	35. 29	44. 77	135. 29	47. 78
Curtiss	69. 23	[1] 11/15/40	92. 31	[1] 11/15/40
Denebola	120. 58	[1] 1/16/40	262. 12	[1] 1/16/40
Detroit	43. 34	22. 26	68. 11	42. 93
Dixie	30. 57	[1] 4/25/40	113. 54	[1] 4/25/40
Dobbin	39. 77	36. 98	28. 41	43. 14
Enterprise	44. 83	[1] 5/12/38	211. 71	[1] 5/12/38

See footnotes at end of table.

Table 3.—*Venereal diseases (class XII) and communicable diseases transmissible by oral and nasal discharges (class VIII), ships and shore stations, for the quarter ending June 30, 1941*—Continued

Ship or station	Venereal diseases (class XII)		Communicable diseases (class VIII)	
	Rate per 1,000, 2d quarter, 1941	Median rate, 2d quarter, 1936–40	Rate per 1,000, 2d quarter, 1941	Median rate, 2d quarter, 1936–40
George F. Elliott	90. 34	[1] 1/10/41	85. 32	[1] 1/10/41
Harry Lee	66. 21	[1] 12/27/40	93. 79	[1] 12/27/40
Helena	15. 84	[1] 9/18/39	118. 81	[1] 9/18/39
Henderson	280. 60	183. 73	168. 93	140. 43
Heywood	12. 13	[1] 2/19/41	129. 42	[1] 2/19/41
Holland	71. 17	89. 54	348. 75	124. 51
Honolulu	14. 57	[1] 6/15/38	149. 36	[1] 6/15/38
Houston	200. 97	86. 55	150. 72	83. 60
Idaho	27. 16	74. 89	89. 61	104. 55
Indianapolis	17. 24	50. 14	86. 21	47. 30
Langley	242. 61	59. 80	217. 73	150. 31
Lexington	32. 70	53. 20	71. 54	126. 56
Louisville	43. 01	75. 00	146. 24	95. 81
Marblehead	449. 37	321. 93	88. 61	95. 03
Maryland	58. 56	53. 79	117. 12	108. 11
McCawley	57. 97	[1] 8/6/40	107. 66	[1] 8/6/40
Medusa	44. 32	92. 14	49. 86	68. 38
Melville	91. 74	68. 18	103. 98	69. 84
Memphis	147. 14	115. 16	245. 23	69. 09
Milwaukee	198. 58	54. 17	232. 62	48. 98
Minneapolis	36. 78	70. 37	96. 55	100. 80
Mississippi	19. 07	61. 12	297. 00	77. 12
Mount Vernon	125. 61	[1] 6/2/41	100. 49	[1] 6/2/41
Nashville	35. 75	[1] 6/6/38	111. 22	[1] 6/6/38
Nevada	21. 96	31. 89	144. 00	98. 36
New Mexico	25. 43	68. 85	279. 72	95. 06
New Orleans	44. 54	58. 30	57. 91	29. 99
New York	91. 71	105. 26	37. 76	75. 79
Northampton	63. 03	54. 71	100. 84	32. 21
North Carolina	117. 70	[1] 4/11/41	221. 38	[1] 4/11/41
Oklahoma	29. 16	63. 94	82. 17	111. 78
Omaha	119. 68	168. 19	359. 05	92. 82
Orizaba	51. 61	[1] 6/15/41	137. 63	[1] 6/15/41
Pennsylvania	25. 97	41. 33	106. 26	94. 46
Pensacola	30. 19	73. 57	75. 47	76. 07
Philadelphia	4. 02	[1] 9/23/37	112. 56	[1] 9/23/37
Phoenix	8. 05	[1] 10/3/38	44. 27	[1] 10/3/38
Portland	35. 01	123. 44	126. 91	56. 89
Prairie	56. 97	[1] 8/5/40	459. 82	[1] 8/5/40
1st Marine Division, Fleet Marine Force	48. 87	[2] 2/1/41	82. 03	[2] 2/1/41
Quincy	55. 97	74. 30	60. 28	31. 58
Raleigh	65. 48	71. 30	166. 67	110. 91
Ranger	73. 46	55. 58	578. 20	92. 64
Relief (duty personnel)	20. 80	61. 07	103. 99	92. 07
Richmond	30. 12	60. 34	18. 07	25. 86
Rigel	77. 26	[1] 3/24/41	23. 77	[1] 3/24/41
Salt Lake City	30. 14	134. 97	103. 34	46. 99
San Francisco	34. 48	75. 83	51. 72	56. 57
Saratoga	61. 60	46. 54	93. 47	121. 44
Savannah	35. 71	[1] 3/10/38	103. 17	[1] 3/10/38
St. Louis	58. 14	[1] 5/19/39	104. 65	[1] 5/19/39
Tennessee	26. 99	78. 18	95. 71	162. 60
Texas	82. 56	108. 08	296. 08	118. 18
Trenton	54. 71	102. 56	30. 40	112. 45
Tuscaloosa	65. 44	63. 31	229. 04	35. 35

See footnotes at end of table.

TABLE 3.—*Venereal diseases (class XII) and communicable diseases transmissible by oral and nasal discharges (class VIII), ships and shore stations, for the quarter ending June 30, 1941*—Continued

Ship or station	Venereal diseases (class XII)		Communicable diseases (class VIII)	
	Rate per 1,000, 2d quarter, 1941	Median rate, 2d quarter, 1936–40	Rate per 1,000, 2d quarter, 1941	Median rate, 2d quarter, 1936–40
Utah	107. 22	61. 27	255. 67	173. 23
Vestal	53. 60	36. 23	73. 70	108. 70
Vincennes	85. 20	[1] 2/24/37	188. 34	[1] 2/24/37
Vulcan	125. 43	[1] 6/16/41	292. 67	[1] 6/16/41
Washington	117. 74	[1] 5/15/41	191. 33	[1] 5/15/41
Wasp	104. 65	[1] 4/25/40	109. 30	[1] 4/25/40
West Point	161. 50	[1] 6/15/41	201. 88	[1] 6/15/41
West Virginia	11. 38	59. 18	195. 68	99. 55
Wharton	22. 47	[1] 12/7/40	179. 78	[1] 12/7/40
Whitney	23. 85	69. 71	83. 46	123. 38
Wichita	70. 03	[1] 2/16/39	177. 14	[1] 2/16/39
Wyoming	98. 50	185. 09	144. 24	123. 39
Yorktown	35. 61	[1] 9/30/37	300. 69	[1] 9/30/37
Navy Yard, Boston, Mass	17. 47	10. 05	145. 56	76. 74
Receiving Station, Boston, Mass	52. 91	25. 97	95. 24	33. 06
Navy Yard, Portsmouth, N. H	35. 21	15. 21	28. 17	130. 23
Naval Torpedo Station, Newport, R. I	38. 89	32. 35	116. 67	43. 13
Naval Training Station, Newport, R. I	2. 48	4. 10	662. 33	491. 46
Naval Air Station, Quonset Point, R. I	33. 96	[3] 7/12/41	210. 53	[3] 7/12/41
Submarine Base, New London, Conn	61. 28	18. 90	191. 50	114. 82
Naval Reserve Radio School, Noroton, Conn	6. 13	[4]	723. 83	[4]
Naval Hospital, Brooklyn, N. Y	59. 54	[4]	341. 00	[4]
District Headquarters, New York, N. Y	0	0	96. 72	26. 67
Naval Reserve Midshipmen's School, New York, N. Y	30. 77	[1] 8/?/40	307. 69	[1] 8/?/40
Navy Yard, New York, N. Y	33. 52	35. 93	122. 90	80. 61
Receiving Ship, New York, N. Y	58. 26	88. 18	170. 31	75. 34
Naval Air Station, Lakehurst, N. J	7. 86	16. 43	70. 73	65. 70
Naval Hospital, Philadelphia, Pa	0	[4]	252. 93	[4]
Navy Yard, Philadelphia, Pa	14. 05	21. 70	87. 40	50. 27
Receiving Station, Philadelphia, Pa	78. 69	69. 23	133. 77	32. 58
Naval Air Station, Anacostia, D. C	23. 21	19. 95	85. 11	55. 17
Marine Barracks, Washington, D. C	30. 69	23. 53	327. 37	101. 58
Naval Dispensary, Washington, D. C	0	[4]	104. 92	[4]
Navy Yard, Washington, D. C	13. 75	17. 51	72. 69	37. 07
Naval Academy (midshipmen), Annapolis, Md	0	0	144. 35	144. 98
Naval Academy (other than midshipmen), Annapolis, Md	61. 87	45. 08	99. 53	101. 27
Marine Barracks, Quantico, Va	16. 11	29. 91	153. 60	129. 08
Naval Air Station, Norfolk, Va	52. 59	72. 92	215. 94	37. 81
Receiving Station, Norfolk, Va	109. 51	151. 75	173. 38	64. 72
Naval Training Station, Norfolk, Va	40. 45	45. 37	332. 17	371. 20
Norfolk Naval Hospital, Portsmouth, Va	30. 89	[4]	455. 60	[4]
Norfolk Navy Yard, Portsmouth, Va	47. 84	65. 79	176. 63	85. 80
Naval Mine Warfare School, Yorktown, Va	49. 69	[1] 1/?/41	107. 66	[1] 1/?/41
Navy Yard, Charleston, S. C	79. 21	31. 87	191. 42	58. 33
Marine Barracks, Parris Island, S. C	16. 76	[4]	141. 06	[4]
Naval Air Station, Jacksonville, Fla	55. 71	[1] 10/15/40	237. 66	[1] 10/15/40
Naval Station, Key West, Fla	50. 80	[1] 11/1/39	90. 91	[1] 11/1/39
Naval Air Station, Miami, Fla	46. 38	[1] 8/1/40	200. 97	[1] 8/1/40
Naval Air Station, Pensacola, Fla	21. 36	37. 24	146. 50	94. 18

See footnotes at end of table.

TABLE 3.—*Venereal diseases (class XII) and communicable diseases transmissible by oral and nasal discharges (class VIII), ships and shore stations, for the quarter ending June 30, 1941*—Continued

Ship or station	Venereal diseases (class XII)		Communicable diseases (class VIII)	
	Rate per 1,000, 2d quarter, 1941	Median rate, 2d quarter, 1936–40	Rate per 1,000, 2d quarter, 1941	Median rate, 2d quarter, 1936–40
Naval Air Station, Corpus Christi, Tex__	63. 93	[5] 3/12/41	204. 92	[5] 3/12/41
Naval Reserve Midshipmen's School, Chicago, Ill_____	0	[1] 9/16/40	248. 28	[1] 9/16/40
Naval Reserve Vocational School, Chicago, Ill_____	0	[1] 10/?/40	941. 18	[1] 10/?/40
Naval Hospital, Great Lakes, Ill_____	0	([4])	632. 41	([4])
Naval Training Station, Great Lakes, Ill_	10. 54	11. 10	742. 33	265. 56
Naval Reserve Training School, Detroit, Mich_____	0	[1] 1/15/41	0	[1] 1/15/41
Naval Mobile Base Hospital No. 1_____	96. 77	[1] 10/5/40	161. 29	[1] 10/5/40
Naval Station, Guantanamo Bay, Cuba__	101. 03	103. 90	87. 26	41. 32
Naval Air Station, San Juan, P. R_____	139. 53	[1] 9/18/39	149. 87	[1] 9/18/39
Naval Dispensary, San Diego, Calif_____	0	0	83. 46	0
Marine Corps Base, San Diego, Calif____	33. 54	42. 18	287. 39	116. 36
Naval Air Station, San Diego, Calif_____	17. 71	33. 52	193. 16	59. 58
Naval Hospital, San Diego, Calif_____	0	([4])	318. 10	([4])
Receiving Station, San Diego, Calif_____	37. 04	63. 69	89. 32	51. 05
Naval Training Station, San Diego, Calif_	17. 28	11. 70	268. 36	317. 49
Roosevelt Base, Terminal Island, Calif__	114. 86	[1] 7/1/37	189. 19	[1] 7/1/37
Naval Air Station, Alameda, Calif_____	52. 20	[1] 11/1/40	130. 51	[1] 11/1/40
Navy Yard, Mare Island, Calif_____	19. 87	44. 33	76. 16	43. 90
District Headquarters, San Francisco, Calif_____	0	0	50. 35	26. 31
Receiving Ship, San Francisco, Calif____	71. 75	132. 16	188. 34	33. 33
Puget Sound Navy Yard, Bremerton, Wash_____	32. 98	26. 18	95. 95	56. 60
Naval Air Station, Seattle, Wash_____	62. 02	44. 03	139. 53	99. 89
2d Marine Aircraft Group, F. M. F., Ewa, Oahu, T. H_____	15. 71	[2] 1/22/41	89. 01	[2] 1/22/41
Naval Air Station, Kaneohe Bay, Oahu, T. H_____	30. 19	[1] 2/15/41	50. 31	[1] 2/15/41
Naval Air Station, Pearl Harbor, T. H___	22. 55	18. 69	55. 12	84. 64
Navy Yard, Pearl Harbor, T. H_____	27. 05	17. 39	50. 72	30. 26
Submarine Base, Pearl Harbor, T. H____	32. 84	52. 63	85. 39	91. 42
Naval Air Station, Coco Solo, C. Z_____	22. 22	85. 45	69. 44	101. 27
Submarine Base, Coco Solo, C. Z_____	25. 76	126. 31	64. 41	188. 52
Navy Yard, Cavite, P. I_____	126. 70	234. 50	18. 10	34. 83
Marine Detachment, Peiping, China____	464. 65	146. 98	282. 83	389. 38
4th Marines, Shanghai, China_____	182. 36	203. 21	245. 79	210. 34
Marine Detachment, Tientsin, China____	108. 84	[1](?) 1938	272. 11	[1](?) 1938
Marine Barracks, Guam, M. I_____	91. 95	86. 33	137. 93	29. 63
Naval Hospital, Guam, M. I_____	219. 78	([4])	0	([4])
Naval Station, Guam, M. I_____	13. 65	18. 43	778. 16	73. 17
Naval Station, Tutuila, Samoa_____	58. 25	0	58. 25	70. 17
1st Defense Battalion_____	24. 27	([4])	63. 11	([4])
2d Defense Battalion_____	40. 56	([4])	148. 70	([4])
3d Defense Battalion_____	0	([4])	172. 77	([4])
4th Defense Battalion_____	178. 34	([4])	173. 25	([4])
5th Defense Battalion_____	25. 32	([4])	131. 65	([4])
6th Defense Battalion_____	61. 92	([4])	20. 64	([4])
7th Defense Battalion_____	35. 63	([4])	53. 45	([4])
1st Battalion, 6th Marines, 1st Marine Brigade_____	12. 09	([4])	108. 32	([4])

[1] Commissioned.   [2] Organized.   [3] Effective.   [4] Not available.   [5] Established.

DEATHS

During the quarter ending June 30, 1941

| Cause | | Num-ber | Navy | | Marine Corps | | Nurse Corps | Mid-ship-men |
Primary	Secondary		Offi-cers	Men	Offi-cers	Men		
Diseases								
Abscess, prostate	Pyemia	1	------	1	------	------	------	------
Adenocarcinoma, pancreas		1	------	1	------	------	------	------
Anemia, splenic		1	------	1	------	------	------	------
Aneurysm, aorta		1	------	1	------	------	------	------
Appendicitis, acute	Peritonitis, general, acute	2	------	2	------	------	------	------
Carcinoma, squamous cell, larynx.		1	1	------	------	------	------	------
Cerebrospinal fever, meningo-coccic.		1	------	1	------	------	------	------
Cirrhosis, liver, atrophic		1	------	1	------	------	------	------
Coronary heart disease, arteri-osclerotic.		6	3	2	------	1	------	------
Diltation, cardiac, acute		1	------	1	------	------	------	------
Diphtheria	Dilatation, cardiac, acute	1	------	1	------	------	------	------
Endocarditis, acute	Pneumonia, broncho	1	------	1	------	------	------	------
Furuncle, face	Septicemia, staphylococcic	1	------	1	------	------	------	------
Heart disease, congenital, pat-ent ductus arteriosus.	Pneumonia, broncho	1	------	1	------	------	------	------
Hemorrhage, cerebral		2	------	2	------	------	------	------
Do	Hypertension, arterial	1	1	------	------	------	------	------
Hemorrhage, subarachnoid		1	------	------	------	1	------	------
Hepatitis, acute		1	------	------	------	1	------	------
Hernia, inguinal, indirect	Hemorrhage, intra-abdom-inal.	1	------	1	------	------	------	------
Hypernephroma	Hemorrhage, retroperito-neal.	1	------	1	------	------	------	------
Hypertensive heart disease		1	------	1	------	------	------	------
Mediastinitis, acute	Cellulitis, neck	1	------	------	------	1	------	------
Meningitis, cerebrospinal, acute.	Abscess, brain	1	1	------	------	------	------	------
Myocarditis, chronic	Obesity	1	------	1	------	------	------	------
Pneumonia, broncho	Granulocytopenia, ma-lignant.	1	------	------	------	1	------	------
Pneumonia, lobar, type un-known.		1	------	1	------	------	------	------
Do	Pleurisy, suppurative	1	------	1	------	------	------	------
Septicemia, staphylococcic		1	1	------	------	------	------	------
Status lymphaticus		1	------	1	------	------	------	------
Teratoma, testicle		2	------	2	------	------	------	------
Thrombosis, coronary artery		1	------	1	------	------	------	------
Do	Embolism cerebral	1	------	1	------	------	------	------
Tuberculosis, pulmonary, chronic, active.		2	------	1	------	1	------	------
Do	Tuberculosis, larynx	1	------	1	------	------	------	------
Tuberculosis, vertebrae, lumbar.	Tuberculosis, intestine	1	1	------	------	------	------	------
Tuberculosis, peritoneum		1	------	1	------	------	------	------
Tuberculosis, pulmonary, acute general miliary.		1	------	1	------	------	------	------
Tumor, mixed, activity un-known, brain.	Hemorrhage, cerebral	1	------	1	------	------	------	------
Typhoid fever		1	------	1	------	------	------	------
Ulcer, duodenum	Pneumonia, broncho	1	------	1	------	------	------	------
Varicose vein, esophagus	Hemorrhage, esophagus	1	------	1	------	------	------	------
Total for diseases		50	8	36	0	6	0	0
Injuries and poisonings								
Burn, multiple		2	------	1	1	------	------	------
Crush, head		2	------	2	------	------	------	------
Crush, trunk		1	------	------	------	1	------	------
Crush, vertebra, cervical		1	------	------	------	1	------	------
Drowning		51	4	44	------	3	------	------
Do	Psychosis, unclassified	1	------	1	------	------	------	------
Electric shock		1	------	1	------	------	------	------
Fracture, compound, femur, tibia, and fibula.	Hemorrhage, traumatic, femoral artery.	2	------	2	------	------	------	------
Fracture, compound, skull		7	2	5	------	------	------	------
Fracture, simple, pelvis	Rupture, traumatic, in-ternal iliac vein.	1	------	1	------	------	------	------
Fracture, simple, skull	Intracranial injury	2	------	1	1	------	------	------

DEATHS

During the quarter ending June 30, 1941—Continued

Cause		Num-ber	Navy		Marine Corps		Nurse Corps	Mid-ship-men
Primary	Secondary		Offi-cers	Men	Offi-cers	Men		
Injuries and poisonings—Con.								
Fracture, simple, vertebrae, cervical.		1	------	1	------	------	------	------
Do	Intraspinal injury	1	------	1	------	------	------	------
Do	Myelitis, transverse	1	------	1	------	------	------	------
Heat exhaustion		1	------	1	------	------	------	------
Heat stroke	Hemorrhage, cerebral	1	------	1	------	------	------	------
Injuries, multiple, extreme		44	16	21	5	2	------	------
Intracranial injury		6	------	4	------	2	------	------
Rupture, traumatic, kidneys and liver.		1	1	------	------	------	------	------
Wound, gunshot, pelvis		1	------	1	------	------	------	------
Wound, gunshot, head		1	------	1	------	------	------	------
Do	Psychosis, unclassified	1	------	------	------	1	------	------
Wound, incised, heart		1	------	1	------	------	------	------
Wound, punctured, chest	Psychoneurosis, anxiety neurosis.	1	1	------	------	------	------	------
Do	Hemorrhage, traumatic subclavian artery.	1	------	------	------	1	------	------
Wound, punctured, neck	Hemorrhage, traumatic subclavian artery.	1	------	1	------	------	------	------
Poisoning, acute, bichloride of mercury.	Psychoneurosis, psychas-thenia.	1	------	1	------	------	------	------
Poisoning, acute, carbon mon-oxide.		1	------	1	------	------	------	------
Poisoning, anesthesia, sodium pentothal.	Abscess, neck	1	------	1	------	------	------	------
Total for injuries and poisonings.		137	24	95	7	11	0	0
Grand total		187	32	131	7	17	0	0
Death rate per 1,000 (annual basis):								
All causes		2.38	5.31	2.23	8.88	1.37	------	------
Diseases only		.64	1.33	.61	------	.48	------	------
Drowning		.66	.66	.77	------	.24	------	------
Poisoning		.04	------	.05	------	------	------	------
Other injuries		1.04	3.32	.80	8.88	.65	------	------

MENTAL AND PHYSICAL QUALIFICATIONS OF RECRUITS

Statistics for the quarter ending June 30, 1941

The following statistics were taken from sanitary reports submitted by naval training stations.

April, May, and June	U. S. naval training station—			
	Nor-folk, Va.	New-port, R. I.	Great Lakes, Ill.	San Diego, Calif.
Recruits received during the period	7, 132	3, 676	5, 077	5, 046
Recruits appearing before Board of Medical Survey	202	73	26	107
Recruits recommended for discharge from the service	202	67	28	107
Recruits discharged by reason of medical survey	114	(1)	0	(1)
Recruits held over pending further observation	73	16	(1)	0
Recruits transferred to the hospital for treatment, operation, or further observation for conditions existing prior to enlistment	(1)	53	6	133

1 Not reported.

The following table was prepared from reports of medical surveys in which disabilities or disease causing the survey were noted existing prior to enlistment. With certain diseases, survey followed enlistment so rapidly that it would seem that many might have been eliminated in the recruiting office.

Cause of survey	Number of surveys	Cause of survey	Number of surveys
Absence, acquired, teeth	4	Gastritis, chronic	3
Absence, congenital	1	Genu valgum	2
Acne, vulgaris	2	Goiter, simple	1
Adhesions, abdominal	1	Gonococcus infection, urethra	5
Adhesions, peritoneum	1	Gonococcus infection, prostate	1
Albuminuria	1	Hallux valgus	1
Alcoholism, chronic	1	Hammertoe	1
Amblyopia	3	Hay fever	2
Amputation, traumatic	1	Heart disease, congenital	3
Arthritis, acute	1	Hemorrhage, subdural	1
Arthritis, chronic	8	Hernia, muscle, fascia, tendon or sheath	2
Asthma	4	Hernia, inguinal, indirect	14
Astigmatism	1	Hernia, ventral	1
Astigmatism, mixed	1	Hydronephrosis	1
Astigmatism, simple, myopic	1	Hypertension, arterial	2
Atrophy	1	Incontinence, urine	1
Bronchiectasis	2	Insufficiency, ocular muscle	1
Burn, chemical	1	Intracranial injury	3
Caries, teeth	9	Joint, internal derangement of	7
Cardiac arrhythmia, premature contractions	1	Malocclusion, teeth	5
Cicatrix, skin	4	Mastoiditis, chronic	1
Color blindness	3	Mental deficiency, moron	10
Constitutional psychopathic inferiority, without psychosis	12	Migraine	5
		Myopia	8
Constitutional psychopathic state, emotional instability	34	Myositis, chronic	7
		Nephritis, chronic	18
Constitutional psychopathic state, inadequate personality	15	Neuritis, sciatic	4
		Neuritis, optic	1
Constitutional psychopathic state, pathological liar	1	Neurosis, intestinal	1
		Neurosyphilis, serological	1
Contracture	2	Nostalgia	5
Cyst	1	Osgood-Schlatter disease	1
Deafness, bilateral	7	Osteochondritis, deformans	1
Defective physical development	2	Osteochondritis, dissecans	1
		Osteochondroma	1
Deformity, acquired	15	Osteochondromatosis	1
Deformity, congenital	9	Osteoma	2
Deviation, nasal septum	2	Osteomyelitis	1
Dementia praecox	8	Otitis media, chronic	32
Diabetes mellitus	2	Pansinusitis, chronic	1
Dislocation, articular cartilage	5	Paralysis, ocular muscle	1
Dislocation, chronic, recurrent	3	Paradentosis	2
Duodenitis	1	Perforated nasal septum	3
Dystrophy, progressive muscular	1	Periostitis, chronic	1
		Pes cavus	1
Effort syndrome	4	Phlebitis, chronic	3
Encephalitis, chronic	2	Pleurisy, fibrinous, chronic	2
Enuresis	60	Pleurisy, serofibrinous	1
Epilepsy	25	Polypus, nasal	1
Epiphysitis, vertebral	1	Prostatitis, chronic, nonvenereal	1
Flat foot	56		
Foreign body, traumatic	2	Psychoneurosis, anxiety neurosis	12
Fracture, simple	2		

Cause of survey	Number of surveys	Cause of survey	Number of surveys
Psychoneurosis, hysteria	15	Synovitis, chronic	2
Psychoneurosis, neurasthenia	6	Syphilis	2
Psychoneurosis, psychasthenia	2	Tachycardia	4
Psychoneurosis, traumatic	8	Tic	1
Psychoneurosis, unclassified	12	Trachoma	1
Retinitis, pigmentosa	1	Tuberculosis, pulmonary, chronic, active	10
Rheumatic fever	13		
Rhinitis, allergic	1	Tuberculosis, pulmonary, chronic, arrested	21
Rhinitis, atrophic	1		
Rupture, traumatic	2	Ulcer, duodenum	11
Sclerosis, disseminated	2	Union of fracture, faulty	5
Sacralization, lumbar vertebrae	1	Valvular heart disease, aortic insufficiency	1
Seasickness	3	Valvular heart disease, aortic and mitral	1
Sexual perversion	1		
Sinusitis, maxillary	1	Valvular heart disease, mitral insufficiency	7
Somnambulism	11		
Sprain, joint	1	Valvular heart disease, mitral stenosis	4
Stammering	1		
Strabismus	2	Varicocele	1
Stricture, ureter	1	Varicose veins	2
Sudamina	1		
Syncope	1	Total	672
Synechia	1		

United States
Naval
Medical Bulletin

UNITED STATES
NAVAL
MEDICAL BULLETIN

FOR THE INFORMATION OF
THE MEDICAL DEPARTMENT OF THE NAVY

⚓

DIVISION OF PUBLICATIONS
THE BUREAU OF MEDICINE AND SURGERY

THE MISSION OF THE MEDICAL DEPARTMENT OF THE NAVY

•

TO KEEP AS MANY MEN AT AS MANY GUNS AS
MANY DAYS AS POSSIBLE

⚓

NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

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Volume X, 1916, No. 2.
Volume XI, 1917, No. 3.
Volume XII, 1918, Nos. 1 and 3.
Volume XXIV, 1926, Nos. 1 and 4.
Volume XXV, 1927, No. 1.
Volume XXVII, 1929, Nos. 3 and 4.
Volume XXVIII, 1930, Nos. 1 and 3.
Volume XXXIII, 1935, No. 3.
Volume XXXIV, 1936, Nos. 1, 2, and 4.
Volume XXXV, 1937, No. 1.
Volume XXXVI, 1938, No. 1.
Volume XXXVIII, 1940, Nos. 1 and 3.

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PREFACE

THE UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originalty and special merit, the Surgeon General of the Navy will send a letter of appreciation to authors of papers of outstanding merit.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T McINTIRE,
Surgeon General, United States Navy.

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Contributions to the BULLETIN should be typewritten, double spaced, on plain paper and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication. For example, addresses, dates, etc., not a part of the article, require deletion by the editor. The BULLETIN endeavors to follow a uniform style in heading and captions, and the editor can be spared much time and trouble, and unnecessary changes in manuscript can be obviated if authors will follow in these particulars the practice of recent issues.

The greatest accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible for the editor to understand or verify references, quotations, etc. The frequency of gross errors in orthography in many contributions is conclusive evidence that authors often fail to read over their manuscripts after they have been typewritten.

Contributions must be received at least 3 months prior to the date of the issue for which they are intended.

The editor is not responsible for the safe return of manuscripts and pictures. All materials supplied for illustrations, if not original, should be accompanied by reference to the source and a statement as to whether or not reproduction has been authorized.

The BULLETIN intends to print only original articles, translations, in whole or in part, reviews, and reports and notices of Government or departmental activities, official announcements, etc. All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere without an understanding to that effect and that editorial privilege is granted to this Bureau in preparing all material submitted for publication.

LOUIS H. RODDIS, *Editor,*
Captain, Medical Corps, United States Navy.
HILTON W. ROSE, *Assistant Editor,*
Lieutenant Commander, Medical Corps,
United States Naval Reserve.

THE NATIONAL NAVAL MEDICAL CENTER

SPECIAL ARTICLES

THE NATIONAL NAVAL MEDICAL CENTER

Rear Admiral Charles M. Oman, Medical Corps, United States Navy

The National Naval Medical Center represents almost a century and a half of progressive development of medical facilities of the Navy in the Nation's Capital.

A medical center was planned many years ago as a part of the Shore Station Development Program, and an act of Congress, approved February 25, 1931, authorized the Secretary of the Navy "to replace, remodel, or extend existing structures and to construct additional buildings, with the utilities, accessories, and the appurtenances pertaining thereto, at the United States Naval Hospital, Washington, D. C."

The act of February 25, 1931, was amended by an act of the Congress approved August 16, 1937, to read as follows:

That the Secretary of the Navy is hereby authorized to construct in the District of Columbia, or in the immediate vicinity thereof, on land already acquired or hereby authorized to be acquired therefor by purchase, gift, or otherwise, buildings to replace the present Naval Hospital and Naval Medical School at Washington, District of Columbia, with the utilities, accessories, and appurtenances pertaining thereto, including facilities for the Naval Medical Center and Naval Dental School: *Provided,* That the advice of the National Capital Park and Planning Commission be requested before the acquisition of property for the purpose and before construction herein authorized shall begin; if located in the District of Columbia, the construction herein authorized be subject to the approval of the National Park Service under authority of section 6 of the Public Buildings Act of May 25, 1926.

The above-cited act was the enabling act. Funds for actual construction were included in the Naval Appropriation Act for the fiscal year of 1939, approved April 26, 1938.

The original intent was to erect the new medical center on the site at Twenty-third and E Street NW., the present location. Architectural drawings were prepared which would place the Administration Building facing north on E Street, with the main approach from Twenty-fourth Street. Space in the Administration Building was to be provided for the medical and dental schools, and wards and other facilities were to have been erected in the space then occupied by the medical school, hospital, and other units.

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The question of selection of a site for the new medical center was a most important one. After careful evaluation of the various problems which arose, viz—the granting of permission from the National Capital Park and Planning Commission, and the procurement of a site of sufficient acreage to permit of future development—the present site was agreed upon. Over 80 sites in the District of Columbia and adjacent Maryland and Virginia were inspected by chiefs of the Bureaus of Medicine and Surgery, and Yards and Docks, or their representatives. Finally, a tract of land, consisting of three parcels, totaling 264.7 acres, was chosen which was thought to be the best of the numerous sites to meet the requirements of the National Naval Medical Center.

This tract is located approximately 1 mile from the village of Bethesda, Md., on the Rockville Pike (U. S. Route 240), and is directly opposite the National Institute of Health of the Federal Security Agency. At time of purchase, it consisted of a gentle rolling field and an area of dense woods along the east section. Extensive grading has changed the entire contour of the area, and it now conforms harmoniously with the architecture of the buildings.

The preparation of the bidding data was carried on by the Bureau of Yards and Docks. Approximately 350 tracings on linen were required for the project, involving over 50,000 square yards of blueprint paper. Contract for the foundations was awarded on June 15, 1939, and on November 22, 1939, a contract was awarded for the structural steel work. Contract for buildings was awarded on April 24, 1940. Ground was broken June 29, 1939, and on Armistice Day, 1940, the cornerstone was laid by the President of the United States in the presence of the Secretary of the Navy and his staff, the chiefs of the various bureaus of the Navy Department, the Surgeons General of the Army and Public Health Service, and many other distinguished guests, including Members of Congress and of the medical profession.

The Bureau of Yards and Docks and the Bureau of Medicine and Surgery discussed available materials for the construction of the Medical Center ranging from brick through limestone, granite, and exposed aggregate concrete. The best of each material mentioned was given consideration, and it was finally decided to use the "precast-exposed aggregate concrete panels," the aggregate being white quartz of opaque and translucent characteristics, crushed and cast in sand of the same quartz material.

The buildings, with the exception of the officers' quarters, are of structural steel, faced with precast-exposed aggregate concrete panels. At a distance, the dark spandrels, vertically situated between the windows, serve to give the main building the appearance of having lofty square columns. The style is monumental, and its balanced beauty gives to the observer a sense of quietness and repose. Various

AUDITORIUM USED IN CONNECTION WITH THE RECREATION OF PATIENTS, IN-
STRUCTION OF STUDENTS AT THE NAVAL MEDICAL AND DENTAL SCHOOLS, AND
FOR MEDICAL MEETINGS AND SIMILAR ACTIVITIES.

MAIN MESS HALL.
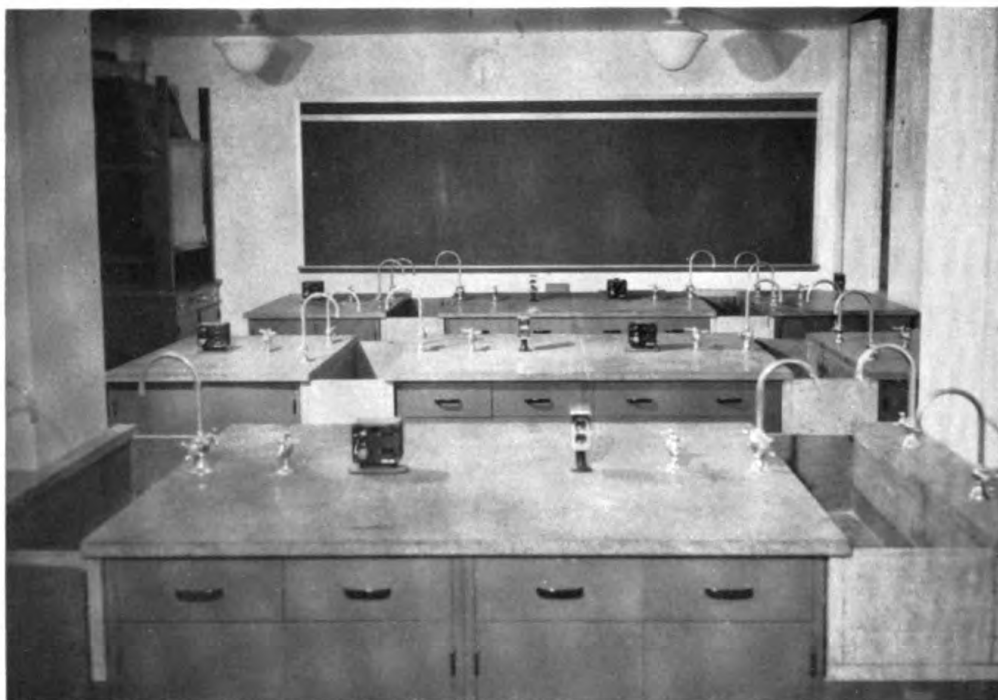
LABORATORY.

OUT-PATIENT EXAMINING ROOM.

MAIN OPERATING ROOM

colored terra cotta tile is extensively used in the interior corridors and rooms, with a most harmonious effect. The lobby is lined with Vermont marble, of three colors, and trimmed with white bronze. The operating suite is on the second floor, and the main operating room, which is lined with pink Tennessee marble, has two glass-enclosed viewing galleries equipped with sound devices for the transmission of the operator's voice.

The tower of the administration building, which is set on a bluff facing the Rockville Pike, dominates the landscape for many miles in all directions. It rises to a height of 558 feet above sea level, and 270 feet above the Rockville Pike, and will be devoted to wards and individual sickrooms. The administration building has a west frontage of approximately 362 feet and is bounded on the north and south by three-story wings which extend from the building to a distance of about 158 feet. The fourth floor of the administration building extends the full length of the wings, and will house principally the x-ray department and an auxiliary surgical service. The tower floors are in the shape of a Geneva cross, the greatest length being approximately 106 feet.

The fifth to the ninth floors will be occupied by one group of patients. The tenth to the seventeenth floors, inclusive, will accommodate other groups, the capacity being about 100. One section of the seventeenth floor and the entire eighteenth floor are occupied by lounges and solariums for the use of patients. The main hospital section is situated in wings extended to the north and south of the main building, and each ward is provided with sunrooms.

The Medical Center consists of a central group of buildings, which includes administration offices, laboratories, classrooms, a surgical pavilion, two-ward buildings, ship's service, commissary, and recreation facilities, including an auditorium seating 600. All these facilities may be said to be under one roof as they are all intercommunicating, either directly or by matching corridor buildings.

The Naval Dental School occupies two floors of the main north wing. It is furnished with the latest equipment for surgical and prosthetic dental procedure. Classrooms and laboratories are provided for postgraduate instruction of naval dental officers and for the training of hospital corpsmen.

The Naval Medical School occupies two floors of the main south wing. This activity will continue with its various laboratories.

The Research Unit, which will occupy a separate building, will be completed during the summer of 1942, and will provide trained personnel and facilities for research and investigation. Most of the projects presented will be of a physiological nature. Special attention will be given to the effects of increased and decreased air pressure having a direct relation to the depth to which divers may

descend, and the heights to which aviators may ascend. A combination high- and low-pressure chamber capable of holding several men at one time, will be provided.

Separated from the main Medical Center group are the Hospital Corps quarters, with accommodations for 276 men, the nurses' quarters, which will accommodate 72 nurses, five sets of officers' quarters, which will be assigned to the medical officer in command of the Center, the medical officer in command of the hospital, the executive officer of the hospital, and the chief of the surgical and medical services.

The National Naval Medical Center includes the Naval Hospital, Naval Medical School, Naval Dental School, and a Research Laboratory. A major portion of the out-patient service work, formerly carried on by the Naval Dispensary, will be transferred to the Medical Center. Equipment of latest design has been provided, including fever therapy, physical therapy, surgery, internal medicine, urology, neuropsychiatry, and other services. The clinical laboratories of the medical school are available for the hospital and out-patient clinic.

The Medical Library at the Medical Center at present consists of more than 20,000 volumes, some of which are rare old books, mostly medical, of the 17th and 18th century. Some of these works are probably nonexistent elsewhere. The library is spacious and can accommodate at least 70,000 volumes, in addition to providing ample reading and study facilities. The library has been cataloged and is supervised by a professional librarian. There is a separate fictional library.

It is intended to grade, seed, and plant the grounds. Trees, native to this country, such as oaks, elms, sycamores, and magnolias will predominate. As development proceeds, recreational facilities will be provided.

President Roosevelt has taken an active part in directing the planning of the National Naval Medical Center from its inception, and has made many suggestions which have contributed to the usefulness and artistic beauty of the buildings and grounds.

THE UNITED STATES NAVAL HOSPITAL, BETHESDA, MD.

By Captain John Harper, Medical Corps, United States Navy

The first naval hospital at Washington, D. C., was established in a building, rented for that purpose near the navy yard. This was, apparently, an old farmhouse with few conveniences, and evidently the one to which Surgeon Thomas Ewell, writing in 1812, offered to give 1 year's pay "to help better its condition."

Surgeon Edward Cutbush, who had been ordered to the hospital established in the city of Washington, mentions in his letters to the

PLATE 5

OLD NAVAL HOSPITAL, WASHINGTON, D. C., IN LATE 1880'S, PENNSYLVANIA AVE. BETWEEN 9TH AND 10TH STS., SE.

MAIN ENTRANCE U. S. NAVAL HOSPITAL, WASHINGTON. D. C., 1941.
SICK OFFICERS' QUARTERS IN BACKGROUND.

Naval Commissioners, in 1815, the $200 a year rent paid for this building.

This hospital was succeeded by the one established at the navy yard, and was discontinued in 1843, when the sick were transferred to the marine barracks. Afterwards, the Civil War caused these accommodations to be insufficient, and in 1861, a temporary naval hospital was established in the Government hospital for the insane; certain wards having been set aside by the Secretary of the Interior for naval purposes. These wards continued to be used until 1866.

War conditions, the increasing importance of the navy yard, and the disadvantages of having a naval hospital under the same roof with insane patients, induced Congress to appropriate $115,000 for the construction of a new building which was commissioned October 1, 1866.

This building, still standing, is located on Pennsylvania Avenue between ninth and tenth streets, southeast, and the original attractive iron railing surrounding the ground is a well-known landmark in that section of the city.

As described by Passed Assistant Surgeon J. D. Gatewood in 1893, the hospital faced south and was 90 feet long and 60 feet deep. Part of the depth was made by small extensions back and front, so that the ground plan resembled a cross with short arms. It was built of brick, and included a basement, two stories, and an attic under a mansard roof.

In the basment, the floor of which was somewhat below the ground level, were the apothecary's quarters, the kitchen, laundry, boiler room, coal-bunker, storerooms, bathroom and water closets. On the first floor were offices, mess room for the men, and quarters for the medical officers on duty. On the second floor were dispensary, officers' ward, nurses' room, and four wards for enlisted men.

The building was lighted by gas from the city, but electric lights were being introduced.

The number of beds at the time.was 26, although the hospital was designed for 50 beds.

In 1871 there were 63 patients under treatment at one time. The staff consisted of a medical director and a passed assistant surgeon; both resided in the building.

At the present time, this building is used as a home for ex-soldiers, sailors, and marines.

During the regime of Surgeon General Presley M. Rixey, adequate appropriation was received for the construction of a number of new naval hospitals including the present naval hospital at Washington, which was completed and placed in commission in October 1906.

As is well known, the Naval Hospital, Naval Medical School, and Naval Dental School occupy the same reservation. Therefore, it is

interesting to read that "the grounds represent a reservation found on L'Enfant's plan of the city of Washington, said reservation, as shown by note on that plan, having been set aside for occupation by buildings devoted to scientific and educational purposes. The reservation extended between Twenty-Third Street and Twenty-Fifth Streets, E Street and the river."

An act of Congress, 1842, authorized the erection of a naval observatory, and President Tyler assigned, for the purpose, this reservation. The building then erected, and now designated as the Naval Medical School, was the Naval Observatory, devoted to that purpose for approximately half a century. It was on January 20, 1894, that, a new naval observatory having been established, the building and grounds were transferred to the Bureau of Medicine and Surgery by order of the Secretary of the Navy, to be used by the Museum of Hygiene.

In 1902 the Naval Medical School was established in Washington, and since that time the building has been continually used as the school. Therefore, it appears that the reservation set aside in L'Enfant's plan for educational and scientific purposes has been so used since its assignment by President Tyler in 1842. This was further emphasized by the fact that 5 acres of the western part of the reservation were transferred to the Treasury Department by act of Congress approved March 3, 1901, to be used by the United States Public Health Service for a laboratory and that part of the reservation, until recently, has been occupied by the National Institute of Health.

The reservation consisted originally of about 21 acres. Therefore the 5 acres diverted for the benefit of the Public Health Service left about 16 acres for use of the Naval Hospital, the Naval Medical and Naval Dental Schools.

The historic value of these grounds is considerably increased by the presence, near the southern boundary, of a rock known as Braddock Rock. It is so called because of the statement that General Braddock landed on the rock in his expedition of 1755, undertaken for the capture of Fort Duquesne. Washington was his aide-de-camp. The rock at that time was, of course, on the water front; but in reclaiming the flats in this locality the region was extensively altered, so that the hospital grounds near the southern boundary were filled in and graded, leaving the rock well below the present surface. This situation necessitated the building of a rectangular well with brick walls, at the bottom of which the rock is now found.

For several years following commissioning, the present naval hospital was known as the Naval Medical School Hospital and for sometime both this hospital and the naval hospital at Pennsylvania Avenue

and tenth streets, southeast, were in commission. In 1911 the latter hospital was discontinued. The Naval Medical School Hospital now became the United States Naval Hospital, Washington, D. C.

The medical officers in command of the old Naval Hospital on Pennsylvania Avenue and the present Naval Hospital will be of interest to many members of the Medical Corps.

NAVAL HOSPITAL, PENNSYLVANIA AVENUE AT TENTH STREET SE. OCT. 1, 1866

Charles D. Maxwell, Surgeon	July 12, 1866 to Oct. 21, 1868
James N. Hyde, Passed Assistant Surgeon	Oct. —, 1868 to Jan. 27, 1869
Francis M. Gunnell, Medical Inspector	Feb. 27, 1869 to Feb. 21, 1872
Charles Eversfield, Medical Director	Feb. 29, 1872 to Oct. 5, 1873
Charles Martin, Medical Director	Oct. 16, 1873 to Oct. 1, 1875
Francis M. Gunnell, Medical Director	Oct. 20, 1875 to Apr. 1, 1879
John Y. Taylor, Medical Director	Apr. 25, 1879 to June 18, 1883
James E. Gains, Passed Assistant Surgeon	June —, 1883 to Dec. —, 1883
Albert L. Gihon, Medical Director	Dec. 27, 1883 to Oct. 1, 1886
David Kindleberger, Medical Director	Oct. 1, 1886 to Apr. 14, 1888
Adolph Hoehling, Medical Inspector	Apr. 14, 1888 to July 17, 1890
Henry M. Wells, Medical Director	July 17, 1890 to July 5, 1893
Albert L. Gihon, Medical Director	July 5, 1893 to Sept. 28, 1895
George A. Bright, Medical Director	Sept. 28, 1895 to Apr. 8, 1899
Abel F. Price, Medical Director	Dec. 1, 1899 to Feb. 25, 1903
George P. Bradley, Medical Director	Apr. 1, 1903 to Oct. 15, 1905
Dwight Dickinson, Medical Director	Oct. 20, 1905 to Nov. 10, 1906
Thomas H. Streets, Medical Director	Nov. 10, 1906 to Mar. 29, 1909
Daniel N. Bertolette, Medical Director	Mar. 29, 1909 to Feb. 7, 1910
Middleton S. Elliott, Surgeon	Feb. 8, 1910 to Feb. 3, 1911

NAVAL MEDICAL SCHOOL HOSPITAL, OCT. 10, 1906

John C. Boyd, Medical Director	Oct. 10, 1906 to Aug. 11, 1908
George E. H. Harmon, Medical Director	Aug. 11, 1908 to June 14, 1910

NAVAL HOSPITAL, FEB. 3, 1911

Lucien C. Heneberger, Medical Director	June 20, 1910 to June 1, 1911
Daniel N. Bertolette, Medical Director	June 1, 1911 to Aug. 7, 1912
James D. Gatewood, Captain (MC) U. S. N	Oct. 29, 1912 to Sept. 25, 1916
Robert M. Kennedy, Captain (MC) U. S. N	Sept. 25, 1916 to Dec. —, 1918
Washington B. Grove, Captain (MC) U. S. N	Jan. 3, 1919 to Jan. 21, 1919
Philip Leach, Captain (MC) U. S. N	Jan. 23, 1919 to Dec. —, 1919
Middleton S. Elliott, Captain (MC) U. S. N	Dec. 29, 1919 to Apr. 4, 1923
Charles H. T. Lowndes, Captain (MC) U. S. N	Apr. 4, 1923 to June 3, 1927
Charles E. Riggs, Captain (MC) U. S. N	June 3, 1927 to Jan. 22, 1929
Theodore W. Richards, Captain (MC) U. S. N	Jan. 30, 1929 to Jan. 8, 1932
Perceval S. Rossiter, Captain (MC) U. S. N	Jan. 8, 1932 to Mar. 17, 1933

NAVAL HOSPITAL, NAVAL MEDICAL CENTER, JUNE 20, 1935

Curtis B. Munger, Captain (MC) U. S. N	Mar. 28, 1933 to Nov. 1, 1935
George C. Thomas, Captain (MC) U. S. N	Dec. 3, 1935 to June 27, 1939
Edgar L. Woods, Captain (MC) U. S. N	Sept. 1, 1939 to July 8, 1940
Robert E. Hoyt, Captain (MC) U. S. N	July 8, 1940

On June 20, 1935, the Naval Medical Center, Washington, D. C., was established by General Order No. 70 to function as a medical, diagnostic and educational center directly under the control of the Bureau of Medicine and Surgery. When established, the Medical Center consisted of two subordinate administrative units, namely, the United States Naval Hospital and the United States Naval Medical School. On April 1, 1936, the Naval Dental School was formed as a distinct unit and attached to the Naval Medical Center by authority of the Secretary of the Navy.

The "old" Naval Hospital, Washington, D. C., was closed February 5, 1942, and was reopened the same day, at Bethesda, Md., as a unit of the National Naval Medical Center.

THE UNITED STATES NAVAL MEDICAL SCHOOL, BETHESDA, MD.

By Captain C. W. O. Bunker, Medical Corps, United States Navy

The approaching uprooting of the present United States Naval Medical School finds many of us cherishing our years of its association. Even those who spent but few weeks or months within its walls usually recall that period with pleasant memories. So, writing concerning this old school partakes of the nature of a requiem.

It is not that no other buildings have housed the program of instruction for the betterment of the professional abilities of our medical personnel and their adaptability to the Service—merely that the present one will have done so for 40 years—the longest of all. We now move to more commodious, better equipped, and more splendid quarters, trusting that this atmosphere will prove as conducive as that of the old to successful efforts for the enhancement of the prestige of our Medical Corps and of our Hospital Corps.

Any attempt now to tell the story of the school would merely repeat much which has been written by others of us. But little of new can be added, and the indulgence of the reader is asked for any sketchiness. Being forced to much repetition, it is suggested that the references at the close of this article be consulted for such fuller details as may be desired. This article deals only with the highlights of the school.

The Naval Medical School is but the present expression of some of our efforts for the training of our medical personnel. Preceding it were others, and we shall endeavor to outline what might be called its ancestry.

It is proper to advise nonnaval readers that the instruction for medical officers at our school is postgraduate work. This is also true of a similar school in England, while those in France afford a complete medical education. Its mission has been well stated as that

PLATE 7
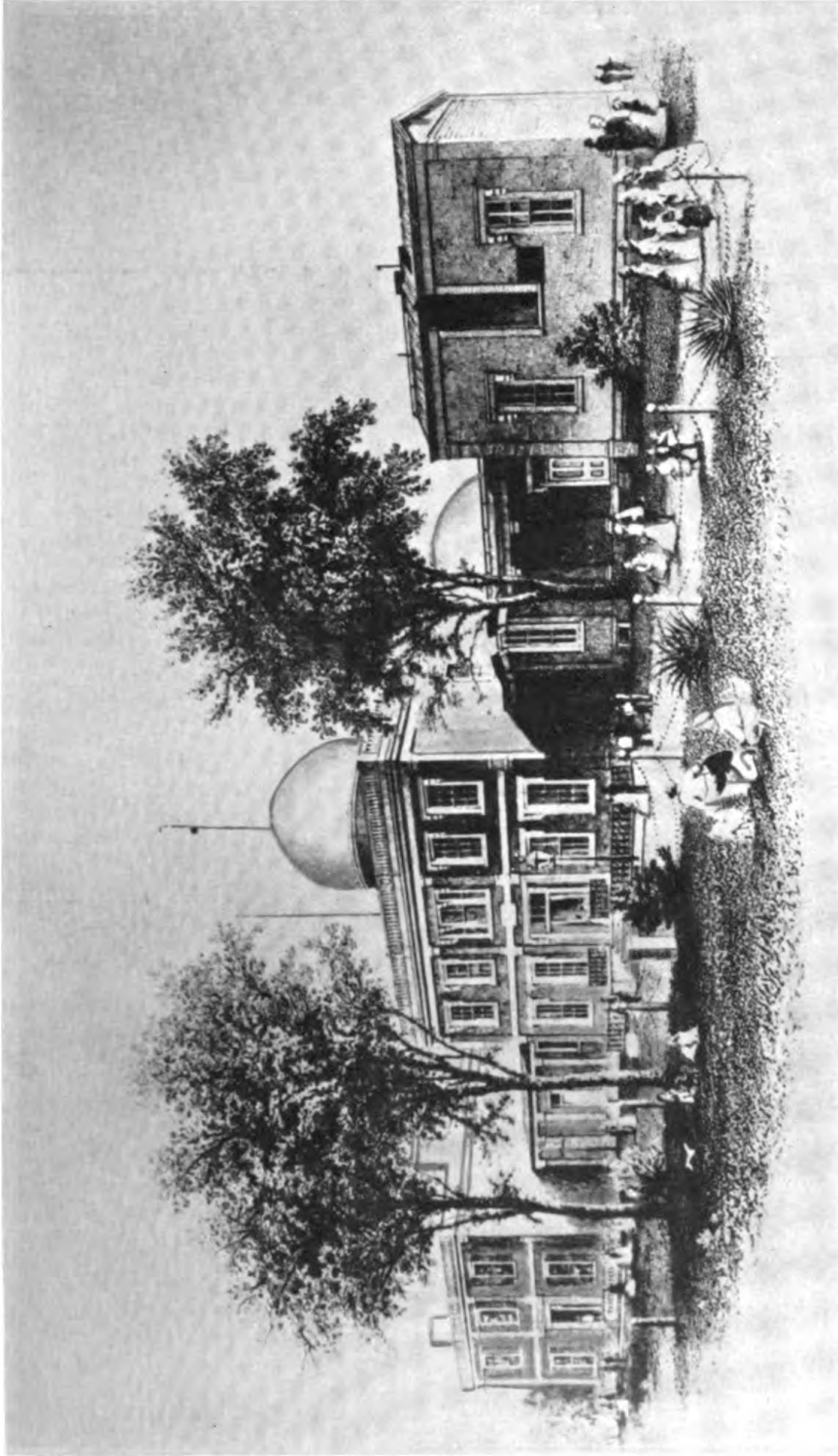
THE OLD NAVAL OBSERVATORY BEFORE THE BUILDING WAS TAKEN OVER AS THE NAVAL MEDICAL SCHOOL, ABOUT THE CIVIL WAR PERIOD OR SHORTLY AFTER.

PLATE 8

OLD NAVAL MEDICAL SCHOOL, WASHINGTON, D. C.

of training of medical officers of the Navy for service afloat and ashore. It will be realized that the naval medical officer, being in a military service, must perform many duties not exclusively of a medical nature, but more purely military. The importance of special training of medical officers of the Navy has long been recognized and advocated. In the Service, we must be competent to solve many problems beyond the usual realm of civil practice, notably those imposed by maritime and other climates where one encounters unusual diseases. Moreover, we must be a part of a military organization and trained to many duties therein.

So, the medical officers under instruction at the Naval Medical School are already graduates in medicine. An endeavor is made to bring them to the school as early as possible after their entry into the Service, and provide them with the necessary training before they are turned loose in the field. At times in the past, it has been the custom to bring more senior officers to the school for what were known as "refresher" courses, so that they would become again abreast with new advances. This opportunity is difficult to secure in the field.

The school provides instruction for enlisted men as well as for medical officers, training them as technicians in various fields. This was started in the present school in 1917 and has continued, much to the benefit of the Service at large. Navy nurses have also completed training as technicians at this school.

Special instruction of this nature was provided in other countries long before our own was organized. France formally opened her first Naval Medical School at Rochefort in 1722. The advantages of teaching were quickly appreciated, and two other schools were soon organized—one at Toulon in 1725, and the other at Brest in 1731. This organization was chiefly due to the efforts of a naval surgeon, Dr. DuPuy. These three schools have continued uninterrupted their output of able naval medical officers despite all the upheavals that country has experienced. As a result of the recommendation of a commission in 1873, they were consolidated into one at Bordeaux, but the elementary work has been continued in the original establishments.

In England, Dr. John Bell, of Edinburgh, advocated a "School of Military Surgery," after the battle of Camperdown (1797). Dr. Robert Jackson fostered the project of an "Army Medical Practical School" in 1805. But it was not until the medical tragedies of the Crimean Wars that the report of a Royal Commission in 1857 led to the establishment of the Army Medical School in 1860 at the Royal Victoria Hospital at Netley. It served for both the Army and Navy until the medical school was formed for the latter in 1880 at Haslar Hospital.

It should not be assumed that the creation of these schools was unopposed. Many years passed before unenlightened stubbornness would accept the idea. The same course was pursued in connection with our own plans. Doubtlessly favored and desired by many, it is of interest to know of some that appear in the record. The prominent naval surgeon (later, our first chief of the Bureau of Medicine and Surgery), author, and educator, Dr. W. P. C. Barton, stressed in 1809, the need of such systematic instruction. Medical Director Edward Shippen visited such schools abroad in 1872, and favorably reported thereon. This was again done by Medical Director R. C. Dean in 1874; Surgeon General Joseph Beale emphasized the need in 1873 and 1874. Surgeon General William Grier instituted a course of instruction for junior medical officers of the Navy at the United States Naval Hospital, Brooklyn, N. Y., during the period 1877 to 1878, consisting of lectures in military surgery and naval hygiene by the hospital staff. The project was not effectively resuscitated until 1893, as will be noted later.

Actual systematized instruction was preceded by other activities allied thereto. On October 1, 1879, Surgeon General P. S. Wales organized a small laboratory, known as the Washington Laboratory, for the investigation of matters pertaining to naval hygiene. He was doubtlessly stimulated in this by the distinguished naval surgeon, J. H. Kidder, a distinguished research scientist, and a member of our Corps. There is now in the chemical laboratory of this school a laboratory desk which was used by him there, and it is still functioning most satisfactorily. Vague legend associates that desk during an earlier period with Surgeon E. R. Squibb.

On January 1, 1882, the Bureau of Medicine and Surgery rented a building at 1744 G Street NW., in Washington, D. C., for a combination of the Laboratory, the Naval Dispensary, and the Museum of Hygiene. The last was a pet project of Medical Director Thomas J. Turner, an authority of that period on public health. On August 7 of that year, an act of Congress was approved, consolidating the Washington Laboratory with the Museum of Hygiene, and, on October 25, a naval medical officer was specifically placed in charge. The establishment moved to the first floor of a building at 1707 New York Avenue on July 1, 1887, this space being also rented. On July 1, 1894, the Museum of Hygiene was moved to the building that had been vacated by the Naval Observatory, it having been transferred to the Bureau of Medicine and Surgery on the 20th of the preceding January for the use of the Museum of Hygiene.

The purpose (11) of the Museum of Hygiene, as outlined in official communications, was the collection, from various sources, of instruments, appliances, inventions, and designs relating to, and

illustrating, the progress of sanitary science in its application to the exigencies of naval life. The institution was not only to be a museum of exhibits, but to serve as an educational center for the promotion and development of laboratory researches, in particular those dealing with chemical, bacteriological, and microscopical investigation. Without doubt, much of the scientific collections of Surgeon Kidder went into the Museum of Hygiene, and it is evident from the results that he zealously labored in the laboratory.

The museum gradually acquired a notable collection, including much related to culture and refinement, as well as that pertaining more particularly to naval hygiene. The Bureau of Medicine and Surgery transferred to the museum, at its opening, its library of about 3,400 volumes, bringing the collection to around 6,000. This library has gradually grown until it is, without doubt, the most important one in the Western Hemisphere, pertaining to naval medicine, although its volumes are by no means confined to that field. There were about 16,000 volumes in 1914, including bound periodicals, and it has now grown to about 23,000. The collections of the museum have been dispersed through the years until nothing of importance remains. A goodly portion of them, particularly notable optical and surgical instruments, has found a home in the National Museum.

In 1893, Surgeon General J. R. Tryon ordered the establishment, at the United States Naval Hospital, Brooklyn, N. Y., of a Department of Instruction, which was joined to the United States Naval Laboratory there, and which was for the purpose of imparting such instruction as might be necessary to familiarize assistant surgeons with the duties of medical officers afloat and on shore. The course of instruction covered a period of 3 months in the following subjects: Chemistry—general, analytical, and organic; hygiene and sanitary science; microscopy and microbiology; military surgery and operative work; clinical medicine and hospital work; construction and ventilation of modern warships; examination of recruits, and life-saving methods; Navy regulations, navy ration, hospital fund, pension fund; keeping medical records at hospitals, on board vessels of war, and blank forms pertaining to Bureau of Medicine and Surgery.

The instruction was given by local naval medical officers, a custom which has continued to the present time, except that, upon moving to Washington, D. C., the school had its own instruction staff and utilized the services of distinguished lecturers from other Government services and from civil life. The instruction was discontinued in 1898, at the outbreak of the Spanish-American War, by reason of the need for medical officers in the field.

It was in 1902 that Surgeon General P. M. Rixey reopened the school and consolidated it with the Museum of Hygiene in Washington, D. C., being then known as the United States Naval Museum of Hygiene and Medical School. The Department of Instruction at Brooklyn was thereby closed, and the Naval Examining Boards there were transferred to Washington, D. C., so that some of the members could serve on the faculty of the new school.

A few words concerning the site of the school will be appropriate. On L'Enfant's plan for Washington, the area was designated for educational and scientific purposes, so this conception was actually realized, and has continued. The land was in the northwest section of Washington, D. C., and it is bounded by Constitution Avenue and E, Twenty-third, and Twenty-fifth Streets. It occupies a 95-foot hillock, in what was an unhealthy spot known as "Foggy Bottom," sloping rather steeply down to the Potomac River which flowed along its edge. First known as Peter's Hill, it was called Camp Hill at the time of the War of 1812, and finally Observatory Hill. It comprised about 21 acres originally, which had shrunk at the time of a survey in 1903 to 17.7 acres, by reason of encroachment of streets. Historically, it is associated with General Braddock's landing and encampment there in 1755 before his ill-fated expedition against Fort Duquesne. In 1792, it was proposed for a fort and barracks. The records indicate that Dr. Benjamin Rush had advanced the idea of a national university (University of the United States) in 1787. President Washington urged this idea, in 1790, in his annual address to Congress, and he again advocated such an institution in 1794, 1795, and 1796, the Commissioners having approved the site in question for the purpose in 1795.

President Adams suggested the hill as suitable for a naval observatory in 1825. This was authorized by Congress in 1842 and completed in 1845. The buildings were transferred to the Bureau of Medicine and Surgery for a Museum of Hygiene in 1894, and remodeled for that purpose. Five and one-tenth acres on the western side were transferred to the Treasury Department in 1901 for the use of the Hygienic Laboratory of the United States Public Health and Marine Hospital Service.

Since the establishment there of the United States Naval Medical School in 1902, as previously mentioned, both medical officers and enlisted men have been trained for their duties, and many valuable contributions to medical literature, general as well as naval, have appeared as a result of work there. Conducting research as well as instruction, it has also served for clinical consultation, and as a laboratory for the Naval Hospital and the Naval Dispensary; and has conducted consultation clinics for individuals, maintained close

liaison with Government and civil medical activities, and has provided instruction and indoctrination for Naval Reserve medical officers, both in actual classes and as correspondence courses.

Although it was feared during the World War that its functions would be interrupted, as happened during the Spanish-American War, this proved not to be the case. Its instruction work increased, and it was the base for the very useful epidemiological and sanitary units. This is again happening during the present war. The increased activity during the first World War resulted in additions to the east and west wings, and in the latter, experimental and research work was established in connection with submarines. Important research work has been, and is being, accomplished. It is the source for Kahn antigen for the entire Navy. Its collections are quite remarkable, notably in pathology and in tropical medicine, all being constantly increased by the contributions of medical officers in the field.

It is interesting to note that the Naval Hospital on the reservation, which was placed in service on October 1, 1906, was known, during September 1906, as The United States Naval Hospital (new), Washington, D. C., and, during that month, its title was changed to The United States Naval Medical School Hospital, and it was so designated for many years.

The length and composition of the courses of instruction for medical officers have varied from time to time, depending upon the exigencies of the Service, some having been as long as 9 months, others as short as 3 weeks. Such a short course as the latter occurs in time of emergency, and is intensively applied so as to afford new medical officers at least a practical glimpse of what they may encounter. All instruction has not been given at the school itself, some work having been definitely accomplished at such places as the Edgewood Arsenal, Edgewood, Md.; United States Marine Barracks, Quantico, Va.; and the Naval Air Station, Anacostia, D. C., all under the supervision of the school. Of course, other instruction, both of medical officers and hospital corpsmen, is accomplished outside of the jurisdiction of the school in various activities, as well as in civilian institutions. The original curriculum at this school in 1902 covered 5 months and included the following subjects: Microscopy, naval hygiene, military surgery, military medicine, duties of the naval medical officer afloat and ashore, and military law. In recent years, a course of eight months has included: allergy, atmospheric hygiene, aviation medicine, bacteriology, cardiology, clinical diagnosis and clinico-pathological conferences, clinical medicine, clinical pathology, endocrinology, hematology, history of medicine, Medical Department duties, medical entomology, military drill, neuro-psychiatry, ophthalmology

and otorhinolaryngology, parasitology, physiological chemistry, preventive medicine and naval hygiene, sanitation, roentgenology, serology, surgery, tropical medicine, urology, chemical warfare, field medical service and aviation medicine.

A six-weeks' course has become necessary during the present emergency and war. It includes the following: atmospheric hygiene, aviation medicine, bacteriology and serology, chemical warfare, damage control, medical department duties, medical field service, military science, naval courts and boards, neuropsychiatry, parasitology, preventive medicine and naval hygiene; surgery, naval and military; tropical medicine, and venereal diseases.

The records indicate that the number of naval medical officers who have completed the course since 1902 is 1482. Eight hundred seventy-five hospital corpsmen have been trained and graduated as technicians. As regards enlisted men, it appears that, at the beginning in 1917, they were trained only in laboratory technic. Succeeding years witnessed other specialties for hospital corpsmen, and they now receive specialized training in: laboratory technic, pharmacy and chemistry, epidemiology and sanitation, photoroentgenography, aviation medicine, roentgenology, electrocardiography and basal metabolism, multigraph, photography and photomicrography.

These hospital corpsmen also receive training in other specialties elsewhere, and, in some of these, at other of our naval medical institutions.

The commanding officers of the United States Naval Medical School, since 1902, have been:

Capt. R. A. Marmion, (MC), U. S. Navy_____ 1902–05
Capt. J. C. Wise, (MC), U. S. Navy_____ 1905–08
Capt. J. C. Boyd, (MC), U. S. Navy_____ 1908–10
Capt. H. G. Boyer, (MC), U. S. Navy_____ 1910–12
Capt. J. D. Gatewood, (MC), U. S. Navy_____ 1912–16
Capt. E. R. Stitt, (MC), U. S. Navy_____ 1916–20
Commander C. M. Oman, (MC), U. S. Navy_____ 1920–21
Commander C. S. Butler, (MC), U. S. Navy_____ 1921–24
Capt. J. C. Pryor, (MC), U. S. Navy_____ 1924–27
Capt. C. S. Butler, (MC), U. S. Navy_____ 1927–32
Capt. W. S. Bell, (MC), U. S. Navy_____ 1932–34
Capt. H. W. Smith, (MC), U. S. Navy_____ 1934–38
Capt. W. Chambers, (MC), U. S. Navy_____ 1938–40
Capt. D. G. Sutton, (MC), U. S. Navy_____ 1940–41
Capt. C. W. O. Bunker, (MC), U. S. Navy_____ 1941–

The reason for this article is the moving of the school to its new quarters at the National Naval Medical Center at Bethesda, Md. The buildings there are being fully described in other articles, and it will suffice here to say that the school is indeed splendidly housed. It will be in the main building, have many rooms in the basement,

part of the south wing on the first floor, one-half of the south wing on the second floor, and all of the third floor.

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THE UNITED STATES NAVAL DENTAL SCHOOL, BETHESDA, MD.

By Captain A. H. Yando, Dental Corps, United States Navy

The Naval Dental School is part of the National Naval Medical Center which in turn contains the Medical School and Naval Hospital. The Dental School has been in existence since February 3, 1923, when the then Surgeon General Admiral Stitt embarked on a vigorous educational program for the Naval Medical Corps and established the Naval Dental School as the Dental Department of the United States Naval Medical School. At that time three dental officers, whose main function was that of instructor in the various phases of dentistry, were attached to the faculty. The student body consisted, usually, of four or five dental officers at a time, sent for instruction twice a year for a period of about 4 months. Classes of hospital corpsmen received instruction as general and laboratory technicians.

Naturally, the difficulties encountered during the functioning of the school were many, and at one time it was discontinued for a period

of about 3 or 4 years. Many problems arose, the majority of which were overcome with the establishment of the equalization bill and increase in rank. Generally the hardships experienced by the Naval Dental School and Corps were similar to those which the whole dental profession had to overcome in order to reach the position among the healing arts that it occupies today.

The equipment and method of instruction used in the dental school in those early days were the envy of many dental schools throughout the country. Many of the courses taught dental officers by the medical faculty were not available at various civilian schools and today are still missing from the schedules of such schools because of the high degree of specilization that is necessary for naval dental officers.

Today, of course, we consider that beginning modest; but at that time the mission seemed revolutionary. Plans for the school have become broader every day and it is hoped that within the next 5 or 10 years, the Naval Dental School, with research material available and the improved quality of dental officers seeking commissions in the corps, will assume a position without parallel and will be unique in its high degree of specialization. From a faculty of three dental officers to one of seven, with plans for increasing the number of specialists in various phases of dentistry with the establishment of this new Naval Medical Center, the growth within the last 18 years has thus been shown. An improvement whereby many commissioned dental officers are sent to the Naval Dental School for indoctrination, as well as training in naval dental research, marks a turning point in the last 3 or 4 years leading to a broader scope of Naval Dental School activities. The new Naval Medical Center contains ample facilities for the expanded activities of the Dental School.

The intimate association of the Naval Dental Corps with the Medical Corps and their common purpose, especially in actual battle, calls for a parallelism in knowledge, instruction, and conditioning of human function for such emergencies. Consequently the dental de partment at the new Naval Medical Center is equipped to more fully and more definitely care for necessary instruction to newly commissioned dental officers; refresher courses for older dental officers, particularly in subjects most pertinent to medico-dento-naval problems, and for enlisted personnel.

Greatly increased facilities are made available for regular operative dentistry and oral surgery with new departments for diagnosis and preventive dentistry. The dental research department is well manned and equipped in larger quarters with animal experimentation available to it. With increased activity in dental field research consolidated and planned in the research department at the suggestion and with the support of Surgeon General McIntire, a definite contribu-

tion to science is assured. Other plans and varied flexible organization of the Dental Corps activities at this center are continuously under way in order to facilitate any change which might occur in treatment and activity planning which definitely concerns dental officers. The Dental Department of this new center is a concrete symbol of the foresighted and tireless efforts of those unselfish dental officers who willingly and without thought of reward have contributed so earnestly to the advancement and prestige of the Naval Dental Corps.

The curriculum and administration of the Naval Dental School is as follows:

The Naval Dental School is under the direct supervision of the commanding officer. The executive officer, in addition to carrying out the administrative decisions of the commanding officer, likewise acts in the capacity of first lieutenant and in these capacities is supervisor of the student body and matériel.

The activities of the Naval Dental School are divided into three main groups, namely: teaching or instruction, clinical, and research. These three groups in turn are subdivided into groups, the details of which are treated separately.

Instruction duties are directed toward three student groups. These groups are: the postgraduate group, comprised of dental officers ordered back from the various stations and ships for refresher courses; the graduate group or newly commissioned dental officers undergoing an indoctrination course; and the undergraduate group composed of hospital corpsmen, leading to a certificate of general or laboratory dental technician.

Regular dental officers making up the postgraduate group are from time to time ordered back to the Naval Dental School for certain courses designed to bring their dental knowledge up to date. These officers are those who have not had the opportunity to keep abreast of new developments in dentistry during a number of years because of the nature and locality of their duties. Courses covered in their instruction are usually of a very practical nature and are supplemented with lectures. Among these courses principally stressed are: recent developments in oral diagnosis, oral bacteriology, prosthesis, oral pathology, oral histology and histo-pathology, some hematology, and oral surgery. Other courses include those in oral and general subjects as given to the graduate group.

The next large group under instruction is the graduate group composed of recently commissioned officers. Instruction is in the nature of indoctrination and is subdivided into three parts. The first part is theory and is composed of lectures and illustrations in oral and general subjects, medico-dento-military subjects and military

subjects. The second is practical work which supplements theoretical subjects. This includes clinics where patients are treated by these dental officers and opportunity is made available to gain experience in naval methods of treating oral conditions, particularly those most frequently encountered. In addition cases of dental interest are presented at various civilian hospitals by their staffs. The military phase is amply covered in a course presented at the Marine Barracks at Quantico, Va., and visits to various naval units. The third part is research, which is a course designed to better acquaint newly commissioned dental officers with the methods that are employed in the Navy in following specific problems. Thesis preparation is required and problems of an original nature may be pursued. Class discussions are likewise frequently held.

Lectures in specific subjects in theory attended by the newly commissioned dental officers in oral and general subjects are: prosthesis, operative dentistry, oral bacteriology, oral clinical pathology, oral histology, oral histo-pathology, surgery, roentgenology, hematology, tropical medicine, urology, ophthalmology, otorhinolaryngology, and cardiology. Lectures in medico-dento-military subjects include: atmospheric hygiene, aviation medicine, naval hygiene, battle surgery and first aid, Manual of the Medical Department, chemical warfare, and medical and dental literature. The medical subjects are given by the faculty of the Naval Medical School.

Military subjects include Uniform Regulations, Navy Regulations, General Orders, circular letters, naval traditions and customs ashore and afloat, collateral duties of dental officers, naval publications, damage control, organization of the fleet, organization of the Navy Department, courts and boards, and social obligations. Lectures in many of the above subjects are given by line officers from the various bureaus of the Navy Department.

The practical work covers besides an application of oral and general subjects; clinical work at the Naval Dental School in oral roentgenology, oral surgery, operative dentistry, and prosthesis. As already mentioned, civilian hospitals are visited and their staffs present patients showing oral manifestations of local and general conditions. Among these patients are those afflicted with tuberculosis, carcinoma, syphilis, nutritional disturbances, radium necrosis, fracture of the jaws and sometimes endocrine disturbances.

Practical military subjects are subdivided into field trips and courses at the Marine Barracks, Quantico, Va., Anacostia, D. C., for aviation observations; Dahlgren, Md., for observation in testing of armaments; the Bureau of Standards, mainly for acquainting the dental officers in methods of testing dental materials and other manufactured products; and the navy yard for visits aboard naval com-

batant ships of various types. Here also diving methods and underwater activities are shown besides an idea in general concerning the functioning of a navy yard. At Quantico, lectures, demonstrations, and drills are presented. Lectures cover the following subjects: military duties, fleet marine force, customs, Navy regulations, discipline, military bearing, organization of the Marine Corps, staff organization of the Marine Corps, chemical warfare, international law, landing operations, medical tactics, dressing of wounds. Demonstrations include guard mounting, manual of the sword, field practice, rifle range, map reading, water purification, and company with troops.

Research required of every dental officer is for the purpose of starting each newly commissioned dental officer on some specific problem early in his career. Instruction in thesis preparation for publication is given and methods of choosing a problem for investigation is outlined. The thesis may be of an historical or bibliographical nature. In addition case reports and abstracts are submitted. Original investigation is encouraged but due to the limited time spent by the dental officers at the Naval Dental School, this in some cases is deferred and stress laid upon an exhaustive variable elimination in the procedure chosen for original work later, as well as bibliographic investigation. The latter is of great value in eliminating repetition in the literature of work or methods already many times reported. Too little reading is done by many workers and consequently much energy is sometimes wasted. Discussions on topics of recent dental meetings and current dental literature are held. This encourages confidence in public speaking and that of taking a more active part in presenting lectures at civilian and naval dental meetings.

Eligibility for enrollment by enlisted personnel in the undergraduate group lies in a certificate as hospital corpsmen from a Naval Hospital Corps training school. Their instruction covers theory and practical work. Theoretical subjects are illustrated by lantern slides and embrace lectures in oral hygiene, oral histo-pathology, oral histology, oral clinical pathology, odontography, oral bacteriology, dental records and forms, supply table data, oral roentgenology, oral prophylaxis, materia medica, therapeutics, office routine, instrumentation, sterilization, and novocaine preparation. Their practical work includes exercises in mixing amalgams and cements, in prophylaxis on manniquins, charting of cases, and keeping records. Dental students technicians receive further practical experience by assisting dental officers at the chair; taking roentgenograms (on each other first and then on patients), and finally a sufficiently long tutored course in actual dental prophylaxis on patients with their own record keeping, charting and handling of appointments. Courses in mechanical dentistry leading to a certificate of laboratory dental tech-

nician are also given. Subjects given are composed of illustrated lectures and practical laboratory exercises covering construction of full and partial dentures using various articulators. In addition courses in construction of various types of fixed and removable bridges, crowns, and inlays are given. Although a certificate as general technician is not required yet such prior instruction is considered invaluable for the student laboratory technician. This completes the courses of instruction to dental officers, recently commissioned dental officers and dental student technicians.

The second main division, namely that of research, is designed to enable certain well qualified dental officers to devote their full time for specified periods to exhaustive original research much of which had been already done by the candidate on his own time. Fellowships of a year or two are planned making all facilities available to the investigator. The nature of such work is divided into three groups; Experimental, statistical, and bibliographical, embracing clinical laboratory and field research. Clinical research includes studies in symtomatology (subjective and objective local and general) and diagnosis (clinical and laboratory which in turn includes physical, chemical, and surgical methods). Laboratory research is available in oral histology, oral histo-pathology, oral bacteriology, physics, chemistry, endocrinology, nutrition, and hematology. Research is carried on in ships and on outlying shore stations and is devoted to experimental, statistical, and bibliographical, clinical, or laboratory studies.

The third main activity group at the Naval Dental School is that of clinical work in which all members of the faculty participate. Dental treatment given to the patients include operative dentistry, subdivided into restorative measures utilizing amalgams, cements, gold inlays and prophylaxis; therapeutic measures are instituted of local and general nature by drugs and medications; oral surgery which includes routine extractions, removal of impacted teeth and tumors, gingivectomy, alveolectomy and treatment of jaw fractures by open and closed methods. Prosthetic appliances of a fixed and removable type using the acrylic resins, ticonium and gold are constructed whenever necessary. This phase is comparable to a routine dental practice in which, as already mentioned, all dental officers on the faculty participate, and is similar to the routine dental treatment made available to the Navy personnel at other naval activities. Patients are principally officers and enlisted men either undergoing general treatment at the Naval Hospital or attached to the station.

The organization as just described has been operating at the old Naval Dental School for the last 3 years. Schedules were found to be sufficiently flexible to meet almost any requirement of any unexpected or emergency nature referring principally to the time factor.

Thus the practicability of this plan can be considered sufficiently proved (fig. 1).

The Naval Dental School occupies the first and second floors and part of the basement in the north wing of the new United States Naval Medical Center (Building 1 with west entrance). The wing in which the school is housed is approximately 156 feet long by 48 feet wide and is divided in its central portion by an 8-foot corridor which gives access to the various offices and rooms. The front entrance leads to the first floor and immediately adjacent thereto is the information desk from which point partial distribution of patients may be affected. For intercommunication a phone system is provided. The examining room serves principally as a means for distributing patients to the proper departments for dental treatment. The officer's and enlisted men's waiting rooms and the examination room are located near the information desk. This room has floor measurements of approximately 10 by 17 feet. The space occupied is similar in measurements to that of other rooms in the school.

The built-in equipment of the school has been designed and planned in accordance with requirements for rendering efficient modern dental services, and providing the necessary facilities of a teaching institution. A brief description of the equipment for the examination room will serve to illustrate the general type of equipment in the operating rooms throughout the school. An electric motor dental chair, the latest type dental unit and operating light are provided. The dental instrument cabinet is all-webbed construction with the exception of a composition top, and drawer pulls. The instrument sterilizer is a cabinet type, automatic in operation and mechanically protected against boiling dry. Special linen cabinets have been designed for the storage of clean towels and to contain the soiled linen. This linen cabinet has a stainless metal top and may be used as a stand for an x-ray illumination box or other convenient uses.

Adjoining the examination room is a linen room measuring 10 by 9 feet. Built-in cases are installed in this area for clean and soiled linen.

Three operating rooms with equipment similar to that of the examination room are also located in the front area of the first floor.

In the midsection of the north side of this wing are located four rooms of the crown and bridge department. These rooms are also supplied with the previously described operating room equipment and in addition specially designed laboratory benches with roll tops and fluorescent lights. The top of the benches are of stainless steel and mounted thereon are bench motors. One of the four rooms is a ceramic room which contains a special bench housing the porcelain furnace.

The small prosthetic laboratory for crown and bridge has a U-shaped bench, with stainless metal top, built around through walls of the room. This bench has been streamlined and contains the following facilities: An icebox, a covered well for casting machine, soldering bench area with concealed blowpipe, a built-in electric hot plate, built-in plaster bins, tables with dust collectors, and a water wheel model trimmer.

Across the corridor from the crown and bridge section are the offices of the commanding officer, and a combined executive officer and record office. These offices contain suitable furniture for administrative activities.

The issue room for stores is approximately 10 by 17 feet in size. The rear part of the room is enclosed in a vault for the storage of precious metals, certain drugs, and nonexpendable instruments. The cabinets of this room line the walls and have been designed especially for the convenient and orderly storage of dental supplies, expendable and nonexpendable. Drawers are of such a size as to house the various dental instruments containing label holders on the front of the drawers for identification of their contents. The shelves of the cabinets are adjustable so that the space between shelves may be varied. Each shelf has a front strip for a label to indicate the stock numbers of the supplies. The fronts of the cabinets have been provided with sliding doors to prevent the accumulation of dust and dirt within. A desk, with fluorescent light, has been provided near the door for recording stock and issue of same.

The oral surgery section, in the rear of the first floor comprises the following rooms:

1. Recovery room, 9 by 12 feet in size, containing a hospital bed, bedside pedistal fountain cuspidor, wardrobe, and chairs.

2. Oral surgery, 14 by 40 feet in size, with light green tile walls and terazzo deck. This room has been provided with a mobile base foot-pump chair, which may be used for table surgery. A standard dental unit with an operating light is installed in one corner of the surgery. Twin operating lights, a portable dental engine and ether and gas apparatus are provided for table surgery. An observation platform has been designed for clinic demonstrations. Two instrument cabinets, wall type, are mounted on the surgery wall.

8. Exodontia room, approximately 12 by 12 feet in size, is provided with an electric motor exodontia type chair and a special overhead operating light, and in addition has the usual standard operating room equipment.

4. The sterilization and scrub room, 7 by 12 feet in size, has a flushed-in wall cabinet designed for the storage of sterile dressings, sterile instrument set-ups, and drugs. A stainless steel metal top is installed as a work bench for making up dressings, boiling solu-

tions and general utility. The sterilizer consists of autoclave, distilled, and hot-water sterilizer, automatic in operation and containing a cabinet for supplies. Two instrument.tables are provided for use in the surgery. The scrub sink is mounted in one corner of the sterilizer room and is equipped with a water-mixing chamber, knee-controlled.

5. X-ray room, 11 by 20 feet in size, is equipped with an electric motor chair, mobile-type x-ray machine, and a fluorescent-lighted viewing cabinet. The viewing cabinet has drawers below for the filing of x-ray films.

6. The dark room possessing also transillumination facilities and measuring 9 by 10 feet in size, has a work bench around three sides of the room. As a part of the bench the following facilities are provided: A lead-lined locker for film storage, a refrigerated developing tank to keep solutions at the optimum temperature, a thermo-valve for maintaining water at the desired temperature, a fan type film dryer, a viewing light flushed into the stainless steel bench top, and two safe-lights mounted on the bench ledge. A number of drawers are provided in the bench for the storage of equipment and supplies.

The second floor of the dental school is set aside largely for teaching purposes as well as for the accomplishment of the greater part of prosthetic dental treatment. In the front area of this floor is found the lecture room, the five-chair clinic, the board room, the dental research laboratory, and the bacteriology, histology, and histo-pathology room.

The lecture room is approximately 17 by 36 feet in size, provided with tablet arm chairs, combination blackboard and beaded screen for projection and projector stand. Two combination storage and display cases are installed in adjacent corners of this room.

The clinic is the same size as the lecture room with five complete dental functioning units. The chairs are electric motor types. The instrument cabinets are of a smaller size than the standard supply table items, and do not occupy as much floor space. A wall cabinet is flushed into the north wall of the room and provides storage space for clinical materials, presents a stainless metal work counter and sink, and has a special compartment for soiled linen. The electric sterilizers for the clinic are cabinet models, automatic in operation. Each dental chair is provided with a unit, an operating light, as well as a special overhead light for general vision.

The board room is 12 by 14 feet in size, and is provided with the usual board room facilities.

The dental research room, 12 by 17 feet in size, has a U-shaped bench with plastic composition top, around three walls. A center

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bench is also installed in the middle of the room. The benches contain drawers and compartments for research materials, microscopes and filing spaces. A desk makes up part of the wall bench. Two reagent cabinets are wall-mounted. This room is equipped with a large specially constructed refrigerator and an incubator electrically controlled for bacteriologic studies. Tissue sectioning machines include those for frozen, paraffin and celloidin-embedded sections. A grinding machine for sectioning of fully calcified dental structures is available for examination of tissue sections for instruction as well as routine diagnostic procedure.

Across the corridor from the clinic are located the dental technicians' laboratory and the bacteriology and pathology laboratory.

The dental technicians' laboratory is 17 by 18 feet in size, has wall and center benches which provide seventeen working spaces for technicians under instruction. In one of the corners of this room is a utility bench for running up models, duplicating, soldering and polishing. This room provides the necessary facilities and work benches for instruction of dental technicians, both general and prosthetic.

The bacteriology, histology, and histo-pathology laboratory, 14 by 17 feet in size, has benches similar in construction to those in the dental research room. These benches provide microscopic tables, desk space, staining trough, soapstone sink, and the various utilities for microscopic studies. Reagent cabinets are wall mounted, with sliding glass doors and adjustable shelves.

The prosthodontia department includes spaces and equipment as follows:

1. Main prosthetic laboratory, approximately 20 by 36 feet in size, has 5 center type benches providing laboratory bench spaces for 12 operators. Each bench space is a complete unit, containing instrument drawers, bench engine, stainless metal top, and fluorescent light. An L-shaped utility bench contains an electric refrigerator, vibrator, waste can, duplicating hot plate, plaster bins, and sink containing a plaster trap. A tooth cabinet, having small individual drawers with a file index card, is designed to contain a suitable selection of artificial teeth.

2. Casting room, approximately 7 by 10 feet, is filled with a streamlined L-shaped bench, with stainless metal top, into which wells are sunk for containing two centrifugal type casting machines and an oven. These wells are provided with covers for protection of the equipment when not in use. Two bench top ovens fitted with pyrometers are supplied for burning out small and large invested cases. The bench also contains a concealed blowpipe for dental soldering.

This room thus serves the dual purpose of taking care of casting with the chrome-cabalt series of metals as well as the noble metals and their alloys. Control boards containing voltmeters, ammeters,

pyrometers, rheostats, turn clocks, and switches are conveniently arranged for ease in operating the equipment.

Adequate ventilation is furnished this room by a ceiling type exhaust fan.

3. The polishing room, approximately 8 by 9 feet in size, contains two fluorescent lighted polishing benches on which are mounted two general utility lathes and two high-speed lathes. In addition these benches also contain dust collectors connected by ducts to stainless steel splash hoods. An opening in the bench top gives access for installing a sand-blaster.

4. Packing, processing, and vulcanizing space is provided in the main laboratory and contains two benches. One of these benches supplies two boil-out tanks, one of the tanks for boiling out wax, the other tank serving for the processing of acrylics. A tank of four automatic electric vulcanizers are flushed into this same table. A hood and blower surmounts the equipment and serves to dissipate the heat generated by the apparatus.

The packing table has a stainless metal top and has two thermostatically controlled hot plates built in its top. This table may be used for the packing of both acrylic and vulcanite cases.

5. On the second floor eight dental chairs will be available for prosthodontia, five of these chairs being in the dental clinic, the other three being contained in private offices which have been fitted out solely for the rendition of prosthetic treatment.

It may be worthy to note that such safeguards as have been found beneficial to health have been incorporated in the design of the school equipment. For instance all operating benches are desk height of 30 inches so that a comfortable upright position may be maintained by the worker. Posture type tools are supplied at all working spaces so that the operators may have proper back support.

The color scheme adopted is as follows: Equipment is standard olive green with wall treatment in cool gray, with the exception of oral surgery which is light green with equipment finished in gray.

HUMAN SERUM ALBUMIN (CONCENTRATED)

CLINICAL INDICATIONS AND DOSAGE

By Commander Lloyd R. Newhouser, Medical Corps, United States Navy, and Lieutenant, junior grade, Eugene L. Lozner, Medical Corps, United States Naval Reserve

Recently, considerable interest has been stimulated by the work of E. J. Cohn and coworkers in the use of a concentrated solution of human serum albumin in the treatment of shock and burns. In view of the acceptance of this therapeutic agent by the Naval Medical Department, it is the purpose of this communication to summarize briefly some of the knowledge concerning human albumin.

The rationale for the use of human albumin in cases of shock is evident from the realization that the albumin fraction accounts for approximately 85 percent of the osmotic pressure exerted by the plasma proteins. Thus, with the exception of fluid volume, most of the "antishock" properties of human plasma are possessed by concentrated albumin. Scatchard has shown *in vitro* and Gibson, Stead and Janeway *in vivo* that 1 gram of albumin will attract approximately 15 cc. of water from the tissues. Twenty-five grams of albumin are therefore roughly equivalent to at least 400 cc. of normal human plasma. A 25 percent solution of pure human albumin has been shown to be stable for temperatures up to 45° C. The advantages that this concentrated solution occupies a relatively small space compared to an equivalent amount of dried plasma, plus its instantaneous availability for emergency use, make human albumin a therapeutic agent of considerable attractiveness in the emergency treatment of shock and burns. The intravenous injection of concentrated albumin leads to hemodilution and restoration of blood volume in a short period of time. This increase of blood volume is at the expense of the tissue fluid which fact must be borne in mind when treating dehydrated patients.

A standard Army-Navy package has been devised for concentrated albumin. A description of this package is shown in figure 1.

THE STANDARD ARMY-NAVY PACKAGE OF ALBUMIN

The standard Army-Navy package consists of 100 cc. of a 25 percent solution of human serum albumin (25 gm. of albumin) in a double ended glass container having a small rubber stopper at each end, complete with airway, intravenous equipment, and suspension tape (bail).
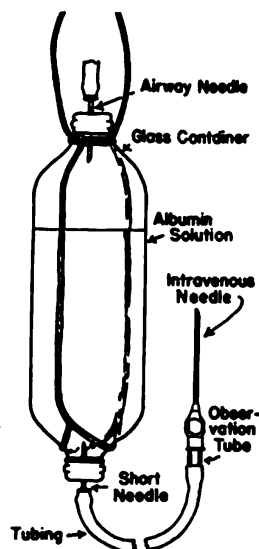
INSTRUCTIONS FOR USE
(These instructions will be stamped on the glass container)

1. Apply alcohol or iodine to both rubber stoppers.
2. Holding container in the upright position, insert air filter needle through top rubber stopper.
3. Insert short needle of the intravenous set through the rubber stopper at the opposite end.
4. Attach intravenous needle to small observation tube.
5. Allow tubing to fill with albumin solution.
6. Insert needle into vein.[1]
7. Suspend container approximately 3 feet above patient.
8. Except in severe shock, the rate of administration should not exceed 5 cc. per minute.

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[1] Venipuncture may be difficult in shock. If necessary cut down on vein or use femoral vein (needle introduced at right angles to skin 1½ inches below mid point of Poupart's ligament just medial to palpable pulsating femoral artery).

CAUTION.—In the presence of dehydration, albumin must be given with or followed by intravenous saline or dextrose and saline.

Dosage.—The ideal dosage of albumin should be regulated by determinations of the red blood count, hemoglobin, hematocrit, and blood pressure. Modern warfare seldom permits such clinical niceties, and the surgeon is usually forced to rely wholly on experience, judgment, and observation.

The treatment of shock should begin before its onset. The medical officer who waits for the clinical picture of shock to develop before instituting treatment invites disaster. Early administration of albumin will prevent the fall in blood pressure associated with the decreased blood volume in shock. Once this fall in blood pressure has occurred and is allowed to persist irreversible tissue changes and death will ensue.

One unit (100 cc. of a 25 percent solution) of albumin may prevent shock in a wounded individual or delay its onset for many hours. Before such an individual is moved any great distance he should receive one unit.

For the successful treatment of traumatic shock and burns, the cardinal principle in administering albumin is, as in giving plasma, to administer an adequate amount early. Depending on severity, one or two units should be given initially. Additional amounts should be given later as determined by clinical response. Since albumin solution is very hypertonic, it cannot be emphasized too strongly that the dehydrated patient receiving albumin solution must also receive concomitantly, or shortly thereafter, an adequate amount of parenteral fluid.

Certain other precautions should be borne in mind in treating the wounded or burned patient in shock. When shock results from hemorrhage, the administration of albumin restores the blood pressure and may cause further bleeding unless all bleeding points are securely ligated. It is therefore of utmost importance to take all the steps to arrest the hemorrhage as soon as possible and to examine the patient frequently following the injection of albumin for evidence of further bleeding. In such patients the administration of albumin or plasma should be regarded only as an emergency measure and should be followed by whole blood as soon as practicable. Severe anemia frequently follows burns, constituting an indication for whole blood rather than albumin. The use of concentrated albumin is contraindicated in the presence of cardiac decompensation where a sudden increase in blood volume might produce serious consequences.

When human serum albumin (concentrated) is available for distribution, all naval medical officers will be notified by form letter.

PARA TROOPS AND PARA PHYSICIANS

By Lieutenant, junior grade, Joseph O. M. Thatcher, Medical Corps, United States
Naval Reserve

Parachute jumping is safe, as thousands of jumps have proven. It is becoming more so as knowledge, practice, and progress are obtained. This requires careful checking of parachute mechanism, exactness in the rules of jumping, and perhaps the most important, the proper selection of jumping personnel. Negligence in the medical selection of personnel and lack of precautionary measures during the actual jump lead to injuries and even sometimes loss of life, both of which must be avoided.

Analyzing the parachute jump in its entirety, as well as in its individual stages, we know that the conditions of the jump and its effect on the human body, both psychologically and physiologically, require the utmost care in the selection of men; and it is necessary that the fitness of the men, and the careful selection of the troops should be precautionary to a degree of perfection. Hence, a very important progressive step would be the organization of a medical selection board, which at a minimum should be comprised of specialists such as: an internist, otolaryngologist, ophthalmologist, and above all a good psycho-neurologist.

Men selected physically should be in perfect health, without any defects or diseases. Their physical development should be such as to withstand the stresses and strains to which the parachutists are subject, while in training and jumping. Also the element of fatigue, which may ensue in carrying out the mission for which they have been sent, must be withstood by the parachutists. Because the decision of battle may rest upon their ability, foresight, and coordination, these men must also possess great will power and resolution, emotional stability, self control, and resourcefulness.

Psychologically, there is a great difference in parachute jumping and actual flying. It is one thing to fly in a plane and quite another to be able to jump from one. The fear of falling is one of the inborn phobias of mankind, and to select men on the basis that jumping is another form of exercise is as wrong as the frequent statement of medical men that "those who fly can jump." One of the numerous reasons for fatalities of aircraft accidents today is, in reality, the sense of fear which has forced the pilot to trust his disabled ship rather than his means of safety, his parachute.

Because pulse and blood pressure are used as indicators of the neuro-psychic system, it has been interesting to note the effects of the anticipated jump and the jump itself. Observation before the jump shows that in normal men there is a slight rise in pulse (72–90) and blood pressure (112/60 to 140/70). However, in the interim,

FIGURE 1.—READY FOR THE BIG MOMENT. MARINE CORPS PARACHUTE TROOPER
STANDING IN POSITION TO JUMP AT THE DOOR OF HIS TRANSPORT PLANE.

until these men can be examined immediately after they have reached the ground, there is a marked increase in pulse (120–140 plus) and blood pressure (ranging from 160/80 to 188/96). This shows a marked effect on the sympathetic system.

External emotional feelings such as blushing, blanching, tremor of hands and eyelids, stuttering, or continuous smacking of the lips, are expressed in some. There are a few who are externally calm. After the jump there may be observed, in this same group, an assumed nonchalance, excessive gesticulation or bravado. Some appear irritable, others fail to answer ordinary questions such as to what outfit they belong, what day it is, or in what order they jumped from the plane. These latter men, upon careful questioning, usually relate some incident that occurred during the jump. One man remembered striking his shoulder on the side of the door upon leaving the plane, another had failed to feel the opening shock of the chute, and still another had, for the first time, seen the man behind him jump. All of these men showed emotional imbalance. It is conceivable that these men would develop a neurosis. If such were the case, they might easily prove detrimental to their companions when cooperation is essential. Because of this, the problem confronting the medical selection board is to give a real valuation of the emotional temperament of each man.

It is not sufficient to obtain the data of the psychological description of an applicant at any one time. Particularly is this true at the very beginning of his career, because the time is lengthy before the actual parachute jump, and any emotional instability which might appear prior to or during the jump could not be recorded. It would require constant observation of these men during their qualification period and advanced training stages.

It is one thing to discover some physical defect in an applicant and quite another to be able to detect or to make a correct diagnosis of the psychic condition of a man who is to jump from an airplane. Opinions may differ in tabulating the psychic condition of a jumper, but this is not surprising because the evaluation of the psychic condition of any person is difficult due to the fact that it is often based on various individual interpretations.

To understand thoroughly the jumpers' psychological reaction during all stages of the jump, it is desirable that the observer himself perform one or more parachute jumps. Actual experience would be a definite aid to knowledge in making clear some of the neuro-psychic factors. With this knowledge, the constant presence of a physician serving the parachute jumpers is extremely important, essential, and necessary. His cooperation with the instructors would make for better jumping and more efficient parachute troops.

BENDS IN HIGH ALTITUDE FLYING

By Lieutenant Commander J. H. Korb, Medical Corps, United States Navy

For many years it has been noted that when men are subjected to a pressure of several atmospheres some of them were afflicted with the bends after they were returned to normal atmospheric pressure. In the low pressure chamber the same affliction has been repeatedly demonstrated by Behnke.[1] In this chamber the air pressure was reduced from normal atmospheric pressure to a pressure simulating high altitude flying. It has been assumed that bends will occur only in pilots of the fighter type airplane where the rate of ascent is rapid. It is the purpose of this paper to report the occurrence of bends in individuals who were flying in a multi-engined patrol airplane.

This airplane was on a routine instruction and indoctrination flight which lasted for 6 hours. The highest altitude reached was 31,000 feet. The crew consisted of the pilots, the structural chief, and a group of men who were making their first flight on which the use of oxygen was necessary.

The structural chief, in addition to his regular duties, was also the instructor in the technic of the use of oxygen. He had been performing this duty for over 1 year and was considered by all hands to be well informed in the method of the use of oxygen. All members of the crew had worn the oxygen masks at least 2 hours on the ground. The structural chief had worn the oxygen mask at least 10 hours on the ground and had made many previous flights on which the use of oxygen was necessary.

When an altitude of 9,000 feet was attained, all hands were ordered to start using oxygen. The structural chief and two of the men were constantly moving about in the airplane on various missions, and due to the nature of their work, it was necessary for them to remove the oxygen masks for a short period of time at irregular intervals. The structural chief having made many previous flights and having suffered no ill effects, became careless in that when he removed the oxygen mask he unnecessarily delayed in replacing it. The pilots and the men who did not remove their oxygen masks and who did not move around in the airplane did not suffer any ill effects. The structural chief and the men who were moving about in the airplane, and who had occasionally removed their oxygen masks for short periods, had symptoms of the bends. The structural chief suffered the most severe symptoms. His report and his actions as observed by the members of the crew are given in detail:

At an altitude of 24,000 feet he noticed a pain in his right ankle. He had previously slipped and so he attributed this pain to a sprained ankle. After a

[1] Lieutenant Commander A. R. Behnke, Jr., Medical Corps, United States Navy. Personal communication to the author.

few minutes his left ankle began to ache, followed later by pain in both knees, then in both wrists, and, lastly, in both elbows. The time for the development of these symptoms was about one-half hour. Believing that his oxygen apparatus was out of order, he changed the canister. Obtaining no relief, he removed his apparatus and picked up a spare set that had not been used. This likewise did not relieve his pain and so he discarded the second apparatus and connected his oxygen tube to the central supply system. Following this, he experienced difficulty in breathing. He described this sensation as "exaggerated hiccups." By this time he was no longer able to walk and so he sent the following message to the pilot, "I am hot, every bone in my body aches, I must be getting rheumatism, I am having trouble breathing, I guess I am a sissy, my legs gave out." That his anoxemia was not severe was evidenced by the fact that he wrote a coherent message in his usual style of handwriting. The pains in his joints disappeared after a descent to 15,000 feet. He suffered a severe headache for about 18 hours, and felt abnormally fatigued for 5 days. The two men who moved about and occasionally removed their masks, had pain in their knees and ankles when reaching an altitude of 27,000 feet. Their pain disappeared after a descent to 20,000 feet. One of these men complained of fatigue for 2 days. These three men apparently have not suffered any ill effects from this flight as 10 weeks after the flight they were in good health and had no complaints.

The information gained from this flight is of utmost importance. The salient features may be summarized as follows:

1. Bends occurred in personnel whose duties required them to fly at high altitudes.

2. Bends occurred in those individuals who had moved about and who had removed their oxygen masks occasionally for a short period of time.

3. Bends were more severe in the individual who was the most active and who did not replace his oxygen mask as soon as possible after its removal.

4. Bends were most severe in the individual who was the instructor in the proper use of the oxygen apparatus and who had more experience in the use of oxygen equipment than any other individual in the unit.

5. Bends occurred in individuals whose rate of ascent was comparatively slow.

6. Even after instruction, the individuals who had pain in their joints did not recognize these symptoms as being the bends.

7. There is a feeling among personnel that repeated high altitude flights gives them some immunity to the ill effects of lowered atmospheric pressure.

CONCLUSION

It may be stated there are a number of circumstances to be met in the flight surgeon's efforts to extend instruction to flight personnel in preventive medicine and first aid. These problems are, in general, common to the service as a whole.

Regular instruction by the flight surgeon seriously interferes with the already overcrowded work schedule of an aeronautical unit. In order to adequately instruct personnel, classes should meet frequently and examinations should be given to assist them to make practical application of what they have been taught. It has been found that the most satisfactory instruction can be given in small groups, by

informally going to the airplane crews and to groups in the shops. Members of these groups are asked questions, and in discussions, misconceptions are corrected. This method is ideal both from the standpoint of instruction and the personal contact of the crew by the flight surgeon. However, this procedure is time consuming and most flight surgeons are unable to absent themselves from routine medical department duties for indefinite periods of time. It, therefore, is suggested that the flight surgeon maintain close contact with the commanding officer and use every available opportunity for instruction.

A CRITICAL EVALUATION OF RECENT INVESTIGATIONS OF THE PHENOMENON OF AERO-EMBOLISM

By Lieutenant Commander Leon D. Carson, Medical Corps, United States Navy

Aero-embolism (aero-emphysema or bends) is the name of the syndrome affecting pilots, air crews, and balloonists ascending to substratosphere levels. This syndrome is characterized by the occurrence of the following symptoms, in the order of frequency as indicated:

First, and most frequent of all are deep-seated pains in the vicinity of joints of the upper and lower extremities. Regional pain is described as an "ache" or "toothachy" pain appearing most characteristically in the knee joints, ankle joints, elbow joints, toes and wrists.

Second, and much less frequent in occurrence, is itching of the extensor surfaces about elbows or forearms, and occasionally about the superior orbital margins of the eyes.

Third, and less frequently, we find substernal pain or oppression, and more rarely still, acute pulmonary distress or choking sensation.

Fourth, a delayed symptom very frequently observed is that of a peculiar but definite feeling of fatigue or lassitude, which develops quite rapidly three or four hours after exposures to low pressures. This may develop in persons who have shown no symptoms during exposure. Recovery from this fatigued state almost invariably occurs during the following night's sleep.

Behnke and Willmon (12) state that the effects of such fatigue are cumulative, and that such exposure, if repeated daily, should, eventually, result in the development of bends. They also believe that this fatigue is caused by the presence of bubbles of nitrogen insufficient in size or amount to cause pain in the graver manifestations of bends, but possibly capable of producing toxic substances by anoxic cellular destruction, or slowing circulation and impeding venous return to the right heart.

This explanation of the fatigue phenomenon, while based upon entirely logical assumptions, must, of course, be accepted only as an hypothesis, subject to verification or refutation by future and present research studies.

The symptoms attributable to decompression in low pressure chamber studies do not often occur below an altitude of 30,000 feet (barometric pressure of 226 mm.) although one occasionally notes beginning itching or slight joint pains at around 27,500 feet.

The usual experience is that after 35,000 feet altitude, the incidence of frank symptoms increases rapidly and at altitude-pressure corresponding to 40,000 feet most human subjects will sooner or later develop symptoms. Of those who develop joint pains, the symptoms rapidly become more and more acute. About half of those who develop such pains soon reach a condition of partial to complete disability.

Symptoms disappear as soon as subjects are recompressed to pressures corresponding to 25,000 feet. If we accept the hypothesis that bubbles in tissue and in circulation are responsible for the entire symptom complex, then we must further hypothesize that the relief commonly experienced by a relatively slight degree of recompression must be due to the influence of increased barometric pressure upon the size of the evolved bubbles; that these must be recompressed to sufficiently smaller sizes as to cease to offer obstruction to arterioles, and capillaries. The delayed fatigue is probably not so much due to persistence of bubbles of inert gas in tissues and capillary beds, but rather to damage done at the time they attained sufficient size as to cause acute symptoms.

Boothby, W. M., Lovelace, W. R. D., and Benson, O. O. (13), state as follows:

Danger of aero-embolism begins at approximately one-half atmosphere (18,000 feet) although symptoms of sufficient intensity as to be serious are infrequent below 30,000 feet, at least if too long a stay is not made at the high altitude.

They assert the belief that sufficient nitrogen can be removed from the circulating tissue and tissues other than fat by rapid denitrogenation as to render the development of bends unlikely even during rapid ascent to altitudes in excess of 35,000 feet. However, it was noted that although a total of 102 ascents (via low pressure chamber) were made to pressures equivalent to 30,000 feet altitude or more, subjects were maintained at altitude but briefly—10 to 30 minutes except in one test run when two subjects remained at 35,000 feet for a period of 2 hours and 15 minutes.

On this basis, they expressed the opinion that high altitudes may be readily borne without symptoms of aero-embolism by pilots who have been desaturated of nitrogen by exercising for 30 minutes during which time pure exygen is breathed, following which they are connected to the oxygen supply system in the plane and remains on oxygen from the ground level up to ceiling and back to 10,000 feet.

A good deal of publicity has been given to this procedure in aeronautical trade journals and the public press.

Behnke, A. R. and Willmon, in their article previously referred to also "go overboard" to the extent of stating that:

Prevention of air embolism or bends at high altitudes depends upon the removal of the gaseous nitrogen dissolved in the tissues of the body. This removal can be effected by slow ascents to high altitudes, or by removal of gaseous nitrogen from the body before the aviator begins his ascent. One method of producing such decompression is by oxygen inhalation.

However, an occasional discordant note obtrudes itself into the symphony and causes us to wonder as to the accuracy of our hypotheses concerning the nature of this picture we have called "aero-embolism." Such a one as this:

V. V. Streltsov (15) reports as follows:

Of 800 men subjected to barometric pressure of 197 mm. and less, which corresponds to height levels of from 10 to 14.5 kilometers, 55 (about 7 percent) complained of joint pains. In personal experiments the author had noted that pain was first experienced in the small joints of the extremities and later in the large joints (shoulder, elbow, knee). A characteristic feature of the pain is its disappearance when the barometric pressure is increased. The pain as a rule disappears with the descent to levels below 10 kilometers. The author was not able to establish any relationship between the development of the joint pain and the amount of oxygen inhaled. He stresses the importance of differentiating changes resulting from anoxemia from those due to the direct effect of lowered barometric pressure. He found that rabbits taken up in flights to 10 and 11 kilometers without oxygen supply, died and exhibited post mortem pulmonary emphysema, hyperemia and hemorrhages into the lungs and intestinal mucosa, and gas emboli in the large vessels and in the coronary vessels of the heart. Another factor of importance noted in lowered, barometric pressure is the loss of body temperature. The appearance of gas emboli and bubbles in the brain tissue is explained by loss of nitrogen, which, according to the Dalton-Henry law, passes, in a condition of lowered partial pressure, from a soluble state to a gaseous state. Oxygen inhalation was suggested as prophylaxis before going on a flight. Theoretically, this should have the effect of lowering the partial pressure of nitrogen in the lungs, which in turn should lower its tension in the blood. This measure was effective in preventing caisson disease in divers. Prophlactic inhalation of oxygen for 20 minutes to 3 hours, followed by a rapid rise to from 10 to 14 kilometers, failed to have any effect on the development of the joint pain.

Streltsov's work on experimental animals is in agreement with that of other investigators.

In general, it is possible to summarize results of animal experimentation in a few statements. A great deal of valuable research in this direction has been accomplished by research laboratories throughout this country and abroad.

One of the most interesting findings with experimental animals has to do with actual physical alteration of the blood. Hemoconcentration or relative increase in the cellular elements of the circulating

blood, with an accompanying loss of the fluid portion occurs in many animals when subjected to severe bends in low pressure chambers at barometric pressures corresponding to altitudes of 34,000 feet or more. The loss of serum or plasma seems to be due to some factor damaging to the capillary beds causing greatly increased permeability. One result is that the circulating blood becomes viscous to a degree which undoubtedly causes a slowing of circulation in spite of increased cardiac effort.

In fact, the pathological picture and the mechanism of transudation closely parallels that presented as the picture of shock by Dr. R. Charles Adams (16), who refers to published work and opinions of Moon and others.

Quoting from Moon (8):

Shock is a circulatory deficiency, not cardiac and not vasomotor in origin, characterized by decreased blood volume, decreased volume flow and by hemoconcentration.

While loss of blood through hemorrhage, the effect of absorbed toxic substances from injured tissue (the histamine effect on capillaries), disturbance in electrolyte balance (with particular emphasis on potassium), or anoxia, all may of themselves initiate such a cycle, yet usually they are separately, merely contributory.

Capillary atony may eventually reach such development that adding to the total blood volume by transfusion, plasma, or acacia will fail to benefit or to reverse the trend of the cycle.

Recent investigation of the effect of adrenal hormone indicates that this substance plays some important role in reducing capillary permeability, possibly through its tendency to safeguard the electrolyte balance of the blood and tissue fluids. Corticosterone, experimentally, is effective, whereas the desoxycorticosterone preparations are not.

At this point it might be well to consider the effect of lowered barometric pressures upon the adrenal gland and others of the endocrine system. The adrenal gland seems to be particularly susceptible to injury due to decreased pressures in experimental animals. Marked hyperemia and swelling occur which usually persist for some few days after exposure.

Dr. J. E. Sweet (2), in 1918, was one of the first investigators to recognize a relationship between shock and the adrenal function. He stated that the only way in which he could produce experimentally a condition closely resembling surgical shock or wound shock, was by bilateral adrenal removal.

Following him, Rowntree (1925), Banting (1926), Lucas (1926), Swingle (1933) and many other investigators have drawn attention

to this parallel between the condition resulting from adrenal insufficiency and wound shock—notably lowering of blood pressure and marked loss of blood and plasma volume leading to hemoconcentration.

Experimentally, adrenal cortical extract has repeatedly been demonstrated to protect against shock and to benefit animals in which shock has been produced.

Giragossintz and Sundstroem (5) have observed experimentally that rats subjected to low barometric pressures for a considerable length of time, show symptoms resembling those of acute adrenal insufficiency. Injections of cortical hormone were effective in reviving these animals. Daily subjection to low pressure (4 hours per day) resulted in early hypertrophy of the adrenal gland followed by later degenerative changes.

The possibility of fatigue in both acute and chronic altitude sickness being due to adrenal insufficiency was suggested by Armstrong (3) (4) in 1938 and in 1939.

Recently other research workers, realizing that environmental conditions capable of producing such derangements of function as have been demonstrated to some degree in the adrenal glands must, perforce have a profound effect upon the other members of the endocrine gland system, have begun investigations into the effects of altitude and anoxia upon thyroid activity and upon testicular function. One of them with whom the author of this article recently conferred has accumulated enough evidence to indicate that repeated exposures to altitudes with mild anoxia tend to cause a degree of testicular degeneration.

It may develop from all the studies now being conducted in this field that an aviator is subject to a specific type of fatigue or even occupational disability, due to the direct effects of low barometric pressures, anoxia, and chilling to which he is frequently exposed.

Tests of the blood of human subjects in a few instances have failed to demonstrate the phenomenon of hemoconcentration, perhaps because humans are more resistant to the effects of low pressures, as well as the fact that humans have not been subjected to such pressures for such prolonged periods, and in such numbers as is the case with experimental animals.

However, we know that in severe cases of aeroembolism, such as occur in caisson disease, the post mortem findings closely parallel those previously described as occurring in experimental animals. Thorne (14) in reporting upon 300 observed cases of caisson disease, has this to say about pathology observed in fatal cases:

Accumulation of evidence from post mortem examinations further supported the gas emboli theory as the cause of caisson disease. Fatal cases grouped themselves into a rapidly fatal group and a delayed fatal group. In the

rapidly fatal group, death is caused by nitrogen emboli to the vital centers of the brain, the coronary vessels and the pulmonary arteries. In the delayed group, death is caused by secondary complications following neurological manifestations of the disease. After long standing, paralysis of the lower extremities, bed sores, sepsis, anemia. pneumonia and exhaustion usually develop. The significant pathologic changes in the delayed death group are found in the spinal cord. The lumbar and thoracic regions of the cord show areas of necrosis and softening with degeneration and destruction of ascending and descending fibers.

Considering the rather definite symptom complex and pathological picture of bends in caisson workers, and the frequently occurring picture in experimental animals, there would appear to be indication for considerably more physiological research in human subjects. So far as is known to the writer, human subjects have been checked for blood findings with particular reference to hemoconcentration, viscosity, and relative increase in cellular elements during and immediately following subjection to low barometric pressures. Such observations as have been made have been upon human subjects who have not been carried to the point of development of severely disabling bends; and blood studies have not been extended through the follwing hours of recovery.

It seems that the next step of research into this phenomenon should be in the nature of a careful biochemical study of the blood for periods of 4 to 8 hours following the development of bends, bearing in mind that in experimental animals maximum changes do not occur until some time following the removal of subjects from low pressure exposures. Perhaps delayed symptoms such as fatigue, substernal oppression, etc., which persist for some several hours following exposure to low pressures, may be accompanied by interesting, though slight changes in the circulating blood.

CONCLUSIONS

1. The syndrome termed aero-embolism presents a quite uniform symptomatology and can be produced with regularity in humans and experimental animals by subjection to low barometric pressuies.

2. The etiological factor is release of gases normally in solution in body tissues and blood, by rapid reduction of pressure. Bubbles form which are believed to be principally nitrogen. These can be demonstrated in humans and in laboratory animals.

3. Desaturation of blood and tissues of their dissolved nitrogen can be accomplished in considerable degree by replacement with oxygen or oxygen-helium mixtures. This, if carried out prior to subjection to low barometric pressures, either delays or tends to prevent onset of the syndrome,

4. The syndrome, however, has been reported as occurring in spite of replacement of nitrogen by oxygen, leading to the deduction that rapid induction of baromatic pressures as in ascents by aircraft may cause liberation in the form of bubbles of gases other than nitrogen, normally present in body solution.

5. The phenomenon of profound changes in blood concentration and disturbances of capillary permeability regularly occurring in experimental animals leads to the belief that further research on human subjects should be undertaken to establish whether or not any degree of disturbance of concentration, capillary leakage, or of electrolyte balance occurs in humans. The possibility of delayed development of blood changes occurring or reaching maximum development some hours after exposure to low pressures should be considered.

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THE HUMAN SKIN AS AN INDICATOR OF THE DETOXIFYING ACTION OF VITAMIN C (ASCORBIC ACID) IN REACTIONS DUE TO ARSENICALS USED IN ANTISYPHILITIC THERAPY

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The reduction of the toxic side effects of chemotherapeutic drugs is one of the major problems of chemotherapy. During the first period of the development of chemotheraphy every effort was made to modify the chemical constitution of the products synthesized in order to increase their parasitotropic properties and to reduce their organotropic affinities.

More recently it was found that the toxicity of some well established chemotherapeutic agents may be reduced by giving simultaneously certain other substances which produce a detoxifying effect. Ehrlich (1) in one of his earliest classical papers on chemotherapy, pointed out that "reduction" is the most important chemical reaction in the detoxifying process of chemotherapeutic agents, especially the arsphenamines.

Among the various substances recommended and applied as detoxifying agents, vitamin C (ascorbic acid) stands in a unique position. While most of the other substances are products foreign to the body, ascorbic acid is one of the most powerful physiological reducing agents.

Animals like the rat, which are able to synthesize ascorbic acid, respond with an increased formation of this substance to toxic doses of a great number of drugs (2). Man is not able to synthesize it. In man, the vitamin C for detoxification must come either from the ingested food or from the body stores. Syphilitic patients when given neoarsphenamine in therapeutic doses had a more or less marked decline of their plasma ascorbic acid levels (3). The drop in the plasma ascorbic acid was especially pronounced in patients who showed symptoms of intolerance to arsenicals.

The influence of ascorbic acid on the sensitization of guinea pigs to arsphenamine was first reported by Sulzberger and Oser (4). In 1937 ascorbic acid was recommended for the detoxification of arsphenamines in human therapy by Dainow (5). Since his publication other reports (6) (7) (8) (9) (10) (10a) have appeared confirming Dainow's (11) observations, but a number of authors (12) (13) (14) (15) (16) (17) (18) (19) (20) have not obtained as favorable results. The use of ascorbic acid to reduce symptoms of intolerance to arsenical therapy has thus far not found general recognition.

Since 1940 we have attempted to desensitize patients hypersensitive to arsenical drugs by building up and maintaining their plasma ascorbic acid level at an optimal range. In the course of this clinical and biochemical study some observations were made proving that ascorbic acid definitely counteracts the toxic action of neoarsphenamine and mapharsen in man.

It is well known that solutions of arsphenamine become oxidized if they are exposed to air and that such oxidized solutions are much more likely to cause toxic side effects than freshly prepared solutions of the same drug.

In experiments on mice, Dainow (5) showed that the injection of a freshly prepared solution of arsenobenzol killed 35 percent of the animals. When the same solution was allowed to stand for 3 to 5 hours its toxicity increased to such a degree that when injected in the same amounts 70 percent of the mice were killed. However, when ascorbic acid was added to the freshly prepared solution its toxicity did not increase. On the contrary, it was lower than the toxicity of a corresponding freshly prepared solution of arsenobenzol alone. Only 17 to 23 percent of the mice were killed by the ascorbic acid-arsenobenzol mixture. Dainow concluded that by adding ascorbic acid the oxidation of the arsenobenzol radical was inhibited not only in vitro but also in the tissues.

EFFECT OF ASCORBIC ACID ON NEOARSPHENAMINE AND OF MAPHARSEN
IN VITRO

Our studies on arsenicals extend and, in essential points, support Dainow's work. In preparing solutions of neoarsphenamine and mapharsen with and without the addition of ascorbic acid we made the following observations: Freshly prepared solutions of neoarsphenamine vary in intensity of yellow color according to the concentration (5 percent to 30 percent). After standing in open containers these solutions become progressively darker within 1 or 2 hours and after 24 hours they become brownish black. When the containers are filled and stoppered, thus excluding air and avoiding oxidation, no darkening occurs. If enough ascorbic acid is added to the neoarsphenamine solution to make a concentration of 10 percent to 20 percent, the yellow color is intensified to orange. When allowed to stand under the same conditions as the untreated neoarsphenamine solutions, the solutions of neoarsphenamine plus ascorbic acid do not change in color. No darkening nor formation of brownish black products occurs. These solutions, when prepared in higher concentrations, may form precipitates, but the orange-yellow of the freshly prepared solutions is maintained for several days without any appreciable change.

Still more impressive is the protective action of ascorbic acid on solutions of mapharsen. In a concentration of 3 percent this arsenical

forms a clear, faintly yellow solution. On standing for 1 hour, it turns darker, later becomes brown, and after 24 hours is transformed into a turbid brownish black solution. However, when ascorbic acid in amounts sufficient to make a concentration of 10 percent to 20 percent is added to the freshly prepared 3-percent mapharsen solution, it loses its faint yellow color. This solution remains clear and colorless for several days. Even after a week, the solution is still pale yellow or tan like a mapharsen solution that has stood but 1 or 2 hours without the addition of ascorbic acid.

These experiments showed that solutions of neoarsphenamine and of mapharsen may be completely protected from oxidation for at least 24 to 48 hours by the addition of ascorbic acid. The significance of this observation became apparent after we began to make patch tests on patients hypersensitive to arsenicals.

TESTS ON HUMAN SKIN

In our study of patch tests, we compared the reaction of the skin to patches soaked in solutions of arsenicals to which ascorbic acid had been added with those obtained with identical concentrations of these drugs without the addition of ascorbic acid. When the patches, soaked in neoarsphenamine or mapharsen solution alone, were removed for reading after 24 or 48 hours, we noticed that their color was identical with that of the corresponding solution of the arsenical which had stood freely exposed to air for the same length of time. The freshly prepared neoarsphenamine patch is yellow. When removed after 24 hours, it is dark brown. The mapharsen patch is white when fresh, and after 24 hours becomes tan to brown. The patch containing neoarsphenamine plus ascorbic acid is orange at the end of 24 hours, while the mapharsen and ascorbic acid patch is pale yellow.

The technic of our patch tests was based on the method suggested by Schoch (21). The following routine procedure was adopted. A 30-percent solution of neoarsphenamine and a 3-percent solution of mapharsen were freshly prepared. Half the amount of each of these solutions was transferred with pipettes into small tubes. To these were added either 200 mg. or 100 mg. of ascorbic acid per cubic centimeter of solution. Thus we had four tubes containing:

1. 30 percent neoarsphenamine.
2. 30 percent neoarsphenamine plus 20 percent or 10 percent ascorbic acid.
3. 3 percent mapharsen.
4. 3 percent mapharsen plus 20 percent or 10 percent ascorbic acid.

The patches were made of a double layer of surgical gauze about 6 mm. square. The skin was cleaned with acetone or carbon tetrachloride. The

patches soaked in the various solutions were transferred to the skin by means of glass rods, thus avoiding contact with metal instruments. The patches were covered with broad strips of adhesive tape with a central piece of rubber or cellophane. They were thereby kept in close contact with the skin without exclusion of air. The tests were usually done on the flexor surface of the arms. In a number of female patients the back was used. Care was taken to apply the patches containing the pure drug on areas symmetrical with those containing the drug plus ascorbic acid. Most of the patients returned for reading of the test after 24 hours. In a few instances circumstances caused a delay of 48 hours. If the first readings were doubtful, they were again observed after 48 to 72 hours.

Like Schoch (22) (23), we included as "positive" only reactions with vesicles, bullae, oozing, or sloughing of the skin. Papules, erythema, and induration were recorded but were not regarded as positive. No distinction was made between immediate (within 24 hours) and delayed (later than 24 hours) positive reactions. If we had followed Cormia's (18) classification a considerably larger number of patch tests would have been recorded as positive (+, ++, or even +++).

The protective action afforded the human skin against arsenical toxicity by the local application of ascorbic acid was first demonstrated by our patch tests. Thirty-eight of 115 patients had a definite positive skin reaction to the 30-percent neoarsphenamine solution, as defined by Schoch. In 32 of the 38 patients, the skin reaction to neoarsphenamine was completely suppressed by the addition of ascorbic acid. In these, not the slightest skin change was visible. The large number of vesicles or even bullae produced by the neoarsphenamine patch was in striking contrast to the smooth and normal skin under the patch containing neoarsphenamine plus ascorbic acid.

In many cases, after 24 or more hours of contact with the patches, the skin became impregnated with the neoarsphenamine solution. Even after the patches were removed, the skin retained the dark color characteristic of a neoarsphenamine solution 24 to 48 hours old. As much of this substance as possible was removed by repeated washing with cotton dipped in lukewarm water.

In 6 of the 38 positive reactors, the skin under the patch containing neoarsphenamine plus ascorbic acid showed some reaction. In all but one of these cases, the skin reaction was decidedly diminished by the presence of the ascorbic acid (see table 1).

TABLE I

Case No.	Symptoms of Intolerence	Patch test							
		30 percent neoarsphenamine				30 percent neoarsphenamine+ ascorbic acid			
		In-dura-tion	Ery-thema	Pa-pules	Vesi-cles	In-dura-tion	Ery-thema	Pa-pules	Vesi-cles
1435	Exfoliative dermatitis; hospitalized..	++	++	0	+++	++	++	0	++
1399	Maculopapular rash	+	+	0	+++	0	0	+	0
1411	Dermatitis and severe dizziness	+	+	0	+	+	+	0	0
963 ¹	Recurrent exfoliative dermatitis	+	+	0	+++	+	+	+	+
1417	Dermatitis	++	++	0	+++	+	+	+	+
1515	Scarlatiniform rash, chills, fever, diarrhea	+	+	0	++	+	+	+++	0

¹ Patient 963 was twice given an intravenous dose of 0.2 gm. neoarsphenamine. The first time he had a plasma ascorbic acid level of 1.28 mg. per hundred cubic centimeters and was taking 300 mg. ascorbic acid by mouth daily of which 257 mg. were excreted in the urine. The second time he received an additional intramuscular injection of 500 mg. sodium ascorbate preceding the neoarsphenamine injection. The plasma ascorbic level was 2.28 mg. per hundred cubic centimeters at that time. Both the injections were followed by rather severe reactions. The patient developed swelling of the face, puffiness around the eyes, and an extensive erythema leading to branny scaling.

No attempt was made to resume arsenical therapy in the other five patients whose local skin reaction to neoarsphenamine was not fully suppressed by the addition of ascorbic acid to the patch test solution. The significance of this lack of prevention of the local reaction deserves further study.

CORRELATION OF SYMPTOMS OF INTOLERANCE WITH PATCH TEST RESULTS.

As previously stated, 115 patients were subjected to patch tests. All but 18 were tested because they had previously shown some symptoms of intolerance to arsenicals. In 74 patients, the skin reaction was negative; in 38, positive; and in 3 doubtfully positive. We have attempted to correlate the previous symptoms of intolerance with the results of the patch test. The patients, grouped according to the predominant symptoms of intolerance, showed the following response to the patch test:

TABLE II

Previous symptoms of intolerance	Positive	Neoarsphenamine patch test	
		Doubtfully positive	Negative
Exfoliative dermatitis	4		0
Dermatitis	6		5
Erythema or rash	6		6
Pruritis	0		16
Severe icterus	1		2
Vomiting, diarrhea, or nausea	11	1	17
General reactions: chills, fever	6	2	14
No symptoms of intolerance	4		14
Total	38	3	74
Grand total	115		

Four patients who had tolerated arsenicals well, had positive patch tests. They will hereafter be designated as "pseudo-reactors." Three

of the four were children, two 9 years old, and one 12. The only adult pseudo-reactor was a man who had had herpes zoster 6 months prior to the test. These skin reactions may have been due more to a high degree of non-specific irritability than due to a true specific hypersensitivity.

No satisfactory parallel exists between the outcome of the patch test and the severity of the gastro-intestinal or general reactions. Of three patients who previously had severe icterus, one had a positive and two a negative patch test. A number of patients who had reacted to arsenical treatment with profuse diarrhea, vomiting, chills, and fever had negative patch tests.

In patients who previously had had skin reactions, the patch test appeared to be a more reliable indicator. All four patients with a history of exfoliative dermatitis had positive patch tests. All 16 who had no dermatitis, erythema, nor rash, but only pruritus had negative patch tests. Subsequent observations, not included in this series, indicate, however, that the patch test cannot be as closely correlated with the skin reactions as these results suggest.

CORRELATION OF PLASMA ASCORBIC ACID LEVELS IN PATCH TEST RESULTS

Next is the study of the relationship between the patch test result and the fasting vitamin C level of the plasma. Values above 1 mg. per hundred cubic centimeters, when found repeatedly, indicate a satisfactory degree of saturation. Levels below 0.3 mg. are found in relatively unsaturated persons. Plasma values between 0.3 mg. and 0.6 mg. per hundred cubic centimeters must be considered low, and between 0.6 and 1.0 as fair. Such persons may be approaching saturation.

At the time the patch test was done the plasma ascorbic acid level was determined in 110 patients. Seventy of them had negative patch tests, 37 positive, and 3 doubtfully positive. The results are compiled in the following table:

TABLE III

Plasma ascorbic acid, mg. per 100 cc.	Patch test results			
	Positives—Number of patients	Percent of total positives	Negatives—Number of patients	Percent of total negatives
Below 0.3	13	33	21	30
0.3 to 0.6	8	20	27	39
0.6 to 1.0	14	35	12	17
Above 1.0	5	12	10	14
Total	[1] 40		70	

[1] Including doubtfully positive.

A number of the above patients were taking oral supplements of ascorbic acid in doses of 100 to 500 mg. per day. These are grouped as follows:

TABLE IV

Plasma ascorbic acid, mg. per 100 cc.	Positive reactors	Negative reactors
Below 0.3	None of the 13	None of the 21.
0.3 to 0.6	3 of the 8	2 of the 27.
0.6 to 1.0	6 of the 14	7 of the 12.
Above 1.0	All of the 5	5 of the 10.

It appears, from the above figures, that the plasma ascorbic acid level does not exert a determining influence upon the outcome of the patch test. Even in patients receiving supplements of ascorbic acid, the patch test remains positive. In order to investigate this question further, the patch test was repeatedly performed on ten positive reactors. All these patients were taking oral supplements of from 150 to 300 mg. ascorbic acid before and on the day of the second patch test. Five patients had fasting plasma levels from 0.64 mg. to 1.0 mg., and the remaining five had more than 1.0 mg. per 100 cubic centimeters.

In six of these patients the second patch test was as strongly positive as the first. In the four remaining patients, however, a decrease in intensity of the second patch test, as compared with the first, was evident. This decrease in intensity was invariably accompanied by a rise in the plasma ascorbic acid level. (Use table V.) Similar observations were reported by Cormia (18).

TABLE V

Case No.	Plasma ascorbic acid level at the time of—	
	First patch test, Mg.	Second patch test of decreased intensity, Mg.
	Percent	*Percent*
1360	0.60	1.20
857	.32	1.12
1359	.38	.96
1379	.24	.36

In contrast, the majority of the patients in whom the second patch test was of about the same intensity as the first, did not respond to the medication with the same degree of rise in the plasma ascorbic acid. (See table VI.)

TABLE VI

Case No.	First patch test, Mg.	Second patch test of equal intensity, Mg.
	Percent	*Percent*
1435	0.52	0.64
854	1.12	1.48
1382A	.70	1.04
1426	.84	.88
1417	.48	.48
1199	.80	.80

PLASMA CONCENTRATION OF ASCORBIC ACID VS. LOCAL CONCENTRATION OF THE SKIN

It may seem surprising that continued oral intake and saturation of the organism with ascorbic acid should have little or no effect on the skin reaction, while the same reaction in the same person is completely prevented by the local application of small quantities of ascorbic acid. A closer consideration of the subject may explain why a rise in the plasma ascorbic acid level cannot be expected to exert as great a protective action on the skin as the local application of ascorbic acid. Positive reactions with the 30 percent neoarsphenamine solution were successfully prevented when one part of ascorbic acid was added to three parts of neoarsphenamine. This amount of ascorbic acid was present in the neoarsphenamine solution from the time the patch was applied until it was removed. Each well-soaked patch will absorb approximately 0.1 to 0.15 cc. of the solution containing 30 to 50 mg. of ascorbic acid. The volume of the circulating blood of an adult is about 5,000 cc. When the human organism is saturated, and when the plasma level reaches a peak of 1.5 mg. per hundred cubic centimeters, the total amount of ascorbic acid in the 5,000 cc. of blood is no more than 75 mg. On the basis of our observations, in order to obtain full protection from the neoarsphenamine in the patch test, one-fifth of the total amount of ascorbic acid in the circulating blood would have to be present constantly at the patch-test site. The bulk of the blood is in the internal organs and the skin is poorly vascularized. It will therefore be readily understood that only a very limited fraction of the total 75 mg. of ascorbic acid can possibly reach the small area of skin covered by the patch. This situation is not appreciably changed when the plasma ascorbic acid is brought up to still higher levels. A series of our hypersensitive patients were given intravenous injections of sodium ascorbate. One hour after as much as 500 mg. were injected, the plasma level rose to over 2 mg. but less than 3 mg. per hundred cc. Such heights are maintained for only a short time and sufficient ascorbic acid for

complete protection can hardly be made available at the small area of skin on which the patch is applied.

The situation changes profoundly when the protective action of the blood ascorbic acid is exerted on the neoarsphenamide introduced intravenously in actual therapy. Here the full amount of circulating ascorbic acid becomes effective. Let us assume that the ratio of ascorbic acid to neoarsphenamine found effective in preventing the skin reaction to the patch test is also needed in the circulating blood. On this basis, 0.1 gm. of ascorbic acid in the circulating blood would be sufficient to counteract toxic symptoms produced by 0.3 gm. neoarsphenamine given intravenously. This relationship between circulating ascorbic acid and circulating neoarsphenamine can be established in the circulating blood while it can hardly be approached in a skin area. Our studies do not exclude the possibility that other physiological reducing substances such as glutathione, cysteine, or antioxidase may participate with ascorbic acid in the protective mechanism.

This deduction is supported by our practical experience. Patch tests were performed on 5 of our patients previously intolerant to arsenicals but subsequently successfully treated when sufficiently large oral and intravenous doses of ascorbic acid were given with neoarsphenamine. In one of these cases, a third patch test, performed after completion of the course of neoarsphenamine, became negative; the two patch tests made before the neoarsphenamine was started were definitely positive. This change in the local reactivity of the skin was not accompanied by any appreciable change in the plasma ascorbic acid level (Table VII).

TABLE VII

No.	Patch tests—		Plasma,[1] ascorbic acid, Mg.	Remarks
	With 30 percent neoarsphenamine	With 30 percent neoarsphenamine +10 percent ascorbic acid		
			Percent	
1	Positive, vesicles	Negative	1.20	Before neoarsphenamine was given.
2	Positive, small vesicles.	do	1.04	Do.
3	Negative	do	1.20	After completion of the course totaling 4.0 gm. neoarsphenamine given in 11 injections. Each injection was given simultaneously with 500 mg. sodium ascorbate intravenously.

[1] The patient was given 300 mg. ascorbic acid orally per day.

With the other four patients formerly sensitive to neoarsphenamine the entire course of treatment was also well tolerated. This indicates

that the protective action of ascorbic acid on the injected neoarsphen-amine was complete. At the same time the patch test remained posi-tive. Yet the local application of 10-percent ascorbic acid produced complete prevention of the skin reaction to neoarsphenamine.

These observations demonstrate that the circulating ascorbic acid may exert its protective power against the circulating neoarsphen-amine even though not enough ascorbic acid can be brought to the skin area to prevent reactions from locally applied neoarsphenamine. Therefore, the patch test does not necessarily become negative when complete therapeutic protection is afforded by the ascorbic acid.

The mechanism of the reversal of a positive to a negative patch test will be the object of further studies.

APPLICATION OF THE RESULTS IN ANTISYPHILITIC THERAPY

The general significance of the patch test itself is secondary. The prevention of reactions to neoarsphenamine and the method of detoxfying it are primary. The number of patients who have severe symptoms of intolerance to neoarsphenamine is still considerable. In the recent reports (24), (25) of the Medical Corps of the United States Navy, the following figures are given: during the 15-year period from 1925 to 1939, 1,301,913 doses of neoarsphenamine were administered. Three hundred five severe reactions and 49 deaths were recorded following these injections, or 1 death or severe reac-tion to every 3,678 administrations of the drug. In addition, 618 mild reactions were recorded giving a ratio of 1 reaction to every 1,346 doses of neoarsphenamine administered. Any prospect of a way to reduce the incidence of these unfortunate reactions should be vigorously pursued. Our studies give promise that the majority of hypersensitive patients whose local skin reaction to neoarsphenamine is fully prevented by ascorbic acid, should be able to tolerate intra-venous therapeutic doses of neoarsphenamine if the ascorbic acid in the circulating blood is maintained at a level high enough to inhibit the formation of toxic products of oxidation.

We shall report the results of this method of treatment of patients previously sensitive to arsenicals in a subsequent paper.

SUMMARY

1. When solutions of neoarsphenamine or mapharsen are left in contact with air, brownish-black oxidation products are formed.

2. This oxidation can be prevented for a period of at least 48 hours when one part of ascorbic acid by weight is added to three parts of neoarsphenamine. Mapharsen solution may be protected from oxidation in a similar way.

3. The same oxidation takes place when patches soaked in solutions of neoarsphenamine or mapharsen are applied to the skin. When ascorbic acid is added to the patch test solution these changes can be completely prevented.

4. A total of 115 patients were subjected to patch tests with neo-arsphenamine. Eighteen of these patients were controls who previously had never had symptoms of intolerance to arsenicals. Four of the eighteen control patients had positive patch tests, and were designated as "pseudo-reactors." Of the remaining 97 patients who had previously shown symptoms of intolerance, 60 had negative patch tests to neoarsphenamine. The previous symptoms displayed by many in this group of 60 patients may have been caused, not so much by a sensitivity or allergy to neoarsphenamine, but were rather manifestation of an abnormal pharmacologic response to the drug.

5. A method was developed which demonstrates that typical cutaneous reactions to neoarsphenamine can be completely prevented by the addition of a sufficient amount of ascorbic acid to the neoarsphenamine solution used for patch testing. In 38 patients who gave strongly positive reactions to patch tests with 30 percent neoarsphenamine solutions, control patch tests were simultaneously performed with the same neoarsphenamine solution with added ascorbic acid. Under the patch with added ascorbic acid not a trace of any reaction was noticeable in 32 out of the 38 positive reactors. All but one of the 6 remaining patients showed a strong attenuation of the cutaneous reaction under the patch containing neoarsphenamine plus ascorbic acid.

6. At the time the patch test was performed, the plasma ascorbic acid level was determined in 110 patients. The plasma ascorbic acid level does not exert a determining influence upon the outcome of the patch test. Even in patients receiving supplements of ascorbic acid the patch test remained positive.

7. The small skin area to which the patch test is applied can receive but a very limited amount of ascorbic acid from the circulating blood, even though the plasma level may rise to very high values. For this reason, the ascorbic acid in the circulating blood cannot exert as great an effect in preventing skin reactions to the patch test as does the local application of ascorbic acid.

8. In the circulating blood itself a much higher ratio of ascorbic acid to therapeutic doses of neoarsphenamine can be established. This ratio may reach the proportion (1:3) which, when used locally, was effective in preventing reactions on the human skin.

9. These studies outline a procedure which promises to assist in the prevention of reactions to therapeutic doses of neoarsphenamine in the great majority of hypersensitive patients.

10. To detect patients in whom it would be hazardous to attempt desentization to neoarsphenamine by means of ascorbic acid, the patch test may be done with 30 percent neoarsphenamine plus 10 percent ascorbic acid, omitting the test with neoarsphenamine alone. Patients who react positively to this patch test (arsenical plus ascorbic acid) will almost certainly not be able to tolerate neoarsphenamine better with ascorbic acid than without it. This group of patients is as yet very small.

11. A subsequent report will be given of the results obtained in treating hypersensitive patients in whom arsenical treatment had previously been regarded as absolutely contraindicated.

The patients who were the subject of this investigation attended the Municipal Social Hygiene Clinic, Chicago, and were referred through the courtesy of Dr. O. C. Wenger, Senior Surgeon, United States Public Health Service, Dr. Herman Bundesen, Commissioner, Chicago Board of Health, and Dr. G. G. Taylor, Chief of Clinic, Chicago Board of Health. Dr. Chester J. Farmer, Northwestern University Medical School, and Dr. John L. White, Director of Laboratories, Chicago Health Department, furnished laboratory aid for this investigation. I am indebted to Dr. J. J. McShane, Chief, Division of Communicable Diseases, State of Illinois, for furnishing drugs and vitamins for these experiments. Dr. Hans C. S. Aron and Dr. Regina S. Greenebaum performed the clinical investigation ; and Miss Margaret A. Delanay carried out the nutritional studies on these patients. H. J. Fagen and J. F. Bimmerle made the biochemical analytical tests on these patients. A preliminary report has been submitted for publication to the Journal of the American Medical Association.

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THE LIMITATIONS OF THE X-RAY IN DIAGNOSIS

By Lieutenant Commander Kenneth S. Davis, Medical Corps, United States Naval Reserve

The value and the limitation of the roentgen ray in diagnosis are not well known to those who are not specialists in this field. The limitations of the x-ray in the field of diagnosis are certainly called to attention when one considers the characteristics of the roentgenogram. A finished roentgenogram is simply the record of the physical density of the structures through which the x-rays pass before reaching the film; in other words, the roentgenogram is simply a shadowgram. The quantity of the x-rays that reach the film is definitely shown on the film by the degree of its blackness. Any object between the x-ray tube and the film that absorbs the x-rays will cast a "white" shadow; the degree of whiteness depending on the thickness and density of the object, and also on the penetrability of the x-rays.

The usual tendency in roentgen diagnosis is to consider all films pathological. The average roentgenogram does show variations from the normal, but the great majority of these variations have but little, if any, bearing on the patient's clinical symptoms. For this reason, it is essential to know the normal variations before attempting to interpret the abnormal findings in terms of their pathological significance.

Often the roentgenologist is tempted to interpret poor roentgenograms, to make radiographic diagnoses on indecisive phenomena and to attempt to read pathology into the x-ray film. Never express an opinion on poor or improperly taken films, nor attempt to make a roentgenographic diagnosis until everything possible has been done. It is always necessary to observe the roentgenographic findings with great accuracy before any attempt is made to interpret these findings in terms of pathology. It is always well to follow up the cases that have been x-rayed, getting the final clinical, surgical, histological, or autopsy diagnosis before closing the case on your records. This is the best method possible of improving one's ability in roentgenographic interpretation. The mistakes that one makes register more deeply than the correct diagnoses.

COMMONLY MISINTERPRETED X-RAY SHADOWS

Pseudo fractures.—In children and young adults, the roentgenologist must be on guard in differentiating between epiphyseal lines and fractures. It is always well to take the opposite (uninjured) member for comparison, which will aid greatly in the correct interpretation. It should be the fixed rule in the x-ray laboratory to take both shoulders, elbows, wrists, hands, hips, knees, ankles, or feet in both the antero-posterior and lateral views when the patient is

under 21 years of age. There should be placed in the viewing room a chart which accurately describes the time of appearance of the various centers of ossification, the location and the appearance of the epiphyseal lines, and the age at which they disappear.

Strips of adhesive, overlying bones, muscles, and gas may produce lines which resemble fractures. However, if the film is scanned carefully, the "fracture" line will be seen extending past the margin of the bone. In the hand, the divided scaphoid presents a difficult problem of differential diagnosis, especially if there is a history of trauma. In the foot, there is a frequently encountered anomaly, the os trigonum, which, in many instances, has been diagnosed as fracture (fig. 1). Another anomaly, the os tibiale externum, is frequently mistaken for fracture (fig. 2).

In the spine, one often notices a pseudofracture in the transverse processes of the first lumbar vertebra (fig. 3). Fractures of the articular processes of the spine are rare; anomalies with accessory articular processes occur much more frequently. The smoothness of the line of division and the absence of callus are important points in the diagnosis. In the skull, blood vessel markings and suture lines are frequently mistaken for fracture and, at times, the differential diagnosis is extremely difficult.

Errors in the roentgen interpretation of bone lesions.—Some lesions of bone are plainly shown by the x-ray and typical cases can, as a rule, be readily identified. On the other hand, there are many bone lesions with atypical or borderline x-ray findings so that the roentgenologist cannot give a definite opinion.

In osteomyelitis, there is a period of from 10 to 21 days in which the roentgenogram fails to show any demonstrable lesion. In carcinoma with metastases to bone, there may be a period of several months before bone changes can be demonstrated on the roentgenogram even though the clinical evidence is strongly indicative of lesion.

The differential diagnosis between inflammatory lesion and neoplasm is not always possible, especially in chronic osteomyelitis, bone syphilis and certain neoplasms such as Ewing's tumor and osteogenic sarcoma. Furthermore, it is not always possible to distinguish between benign and malignant neoplasms. Certainly it is, at times, presumptuous for the radiologist to attempt to make an exact diagnosis as to the type of bone tumor since the x-ray does not carry a microscopic attachment.

Shadows mistaken for urinary calculus.—In the upper part of the urinary tract, calcified mesenteric lymph nodes, gallstones, calcified costal cartilages and opaque substance in the gastro-intestinal tract are among the more commonly misinterpreted shadows. In the

lower part of the urinary tract, small, rounded, calcified masses in the pelvic veins called phleboliths are frequently confused with ureteral stone. These occur in about 30 percent of all adults (fig. 4). Other misinterpreted shadows in this region are calcified blood vessel walls and opaque substance in diverticula of the sigmoid colon.

Misinterpreted pelvic shadows.—A full bladder can simulate a soft tissue tumor in the pelvis. Rectal feces and gas often produce shadows which are confusing. Presence of opaque material in the rectum will produce a shadow which simulates, closely, a calcified pelvic tumor. It should be the rule in the x-ray laboratory to repeat the roentgenogram after a cleansing enema when such a shadow is seen.

In roentgenograms of the pelvis, there are occasionally seen shadows which may be very confusing due to the injection of opaque medicines into the buttocks.

Errors in the interpretation of the gallbladder roentgenogram.— Only 25 percent of gallstones are seen on the plain film even with the most exacting technic. If a shadow is present in the right upper quadrant of the abdomen, one must be on guard in differentiating between gallstone, calcified costal cartilage, urinary calculus and calcified mesenteric lymph node. Gallstones may be found in abnormal positions and their clinical significance determined only after a galbladder dye study. Even in the latter examination, there may be seen small "blobs" of gas superimposed over the shadow of the gallbladder simulating cholesterol gallstones in appearance.

Failure of the gallbladder to fill with dye substance does not necessarily indicate a pathological gallbladder. It may indicate disease of the liver, obstruction in the cystic and common bile duct, disease of the head of the pancreas or faulty technic. The gallbladder is never visualized in the presence of deep jaundice.

THE LIMITATIONS OF THE X-RAY IN DIAGNOSIS OF PULMONARY DISEASE

The value of the x-ray in diagnosing pulmonary disease is unquestioned; despite this, there are many positive roentgenographic diagnoses made which are not justifiable. It is a grave mistake to brand a relatively sound person as tuberculous, for this entails a loss of occupation, time and money. On the other hand, a negative x-ray diagnosis in an early minimal tuberculosis is an equally grave mistake since the lesion may soon become incurable. It has been shown that undiagnosed cases of tuberculosis in the army and navy cost the government approximately $25,000 per case.

In miliary tuberculosis of the lung, there is a period of from 1 to 6 weeks in which the roentgenograms will show no demonstrable

FIGURE 1.—SHOWING AN ANOMALY OF THE OS TRIGONUM.

FIGURE 2.—OS TIBIALE EXTERNUM. THIS ANOMALY IS USUALLY BILATERAL
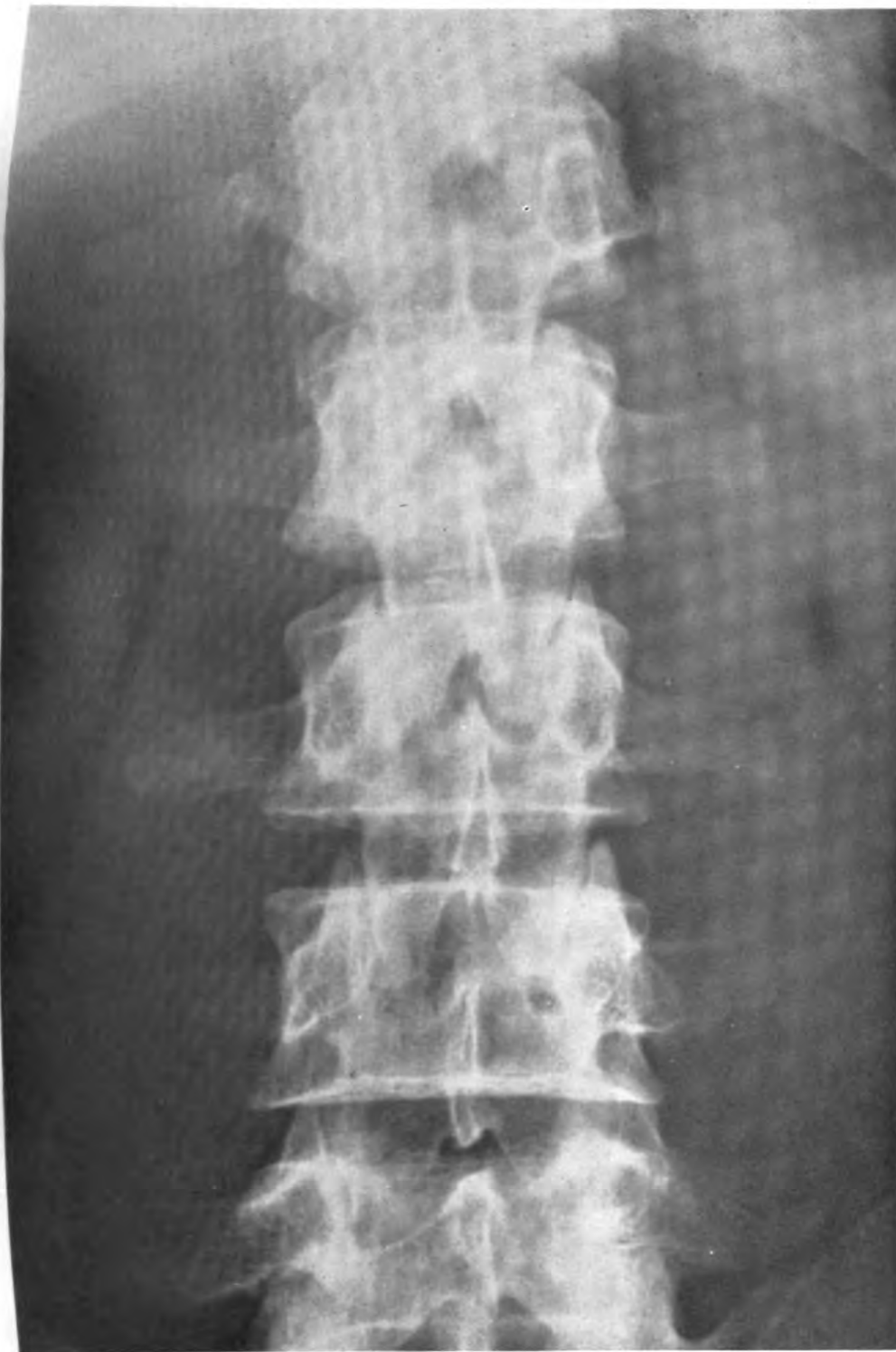BUT AT TIMES IS UNILATERAL.

FIGURE 3.—CONGENITAL ANOMALY OF THE TRANSVERSE PROCESSES OF THE FIRST
LUMBAR VERTEBRA, COMMONLY MISTAKEN FOR FRACTURE.

FIGURE 4.—PHLEBOLITHS. THESE OCCUR IN ABOUT 30 PERCENT OF ADULTS
PAST 30 YEARS OF AGE. OFTEN ON THE PLAIN ROENTGENOGRAM THEIR
CLINICAL SIGNIFICANCE IS INDETERMINATE WITHOUT FURTHER UROGRAPHIC
STUDIES.

evidence of disease and the roentgenologist should be on guard in his clinical interpretation of the negative roentgen findings.

Many cases of bronchial pneumonia closely simulate a pulmonary tuberculosis in appearance on the roentgenogram but when a check film is made in from 2 to 3 weeks, there will be found a complete resolution of the lesion when it is pneumonic in character.

Many cases of primary carcinoma of the lung have been diagnosed as pneumonitis or tuberculosis and their true nature only suspected because of the alertness of the clinician.

Tumors of the lung and mediastinum are easily depicted by the x-ray but here again, the type of the tumor cannot be accurately determined in all cases. The internist should not expect the roentgenologist to specifically state the type of the tumor, whether benign or malignant, etc., for the x-ray cannot see cells.

THE LIMITATIONS OF THE X-RAY IN GASTRO-INTESTINAL DIAGNOSIS

In gastro-intestinal diagnosis, the x-ray is undoubtedly one of the most valuable and also one of the most abused adjuncts which the internist and surgeon have. Failure to discover a lesion by the x-ray is often pardonable but the subjection of a patient to a needless operation on trivial roentgen evidence alone is not readily forgiven by those concerned. In doubtful cases, the radiologist should repeat the examination as many times as he deems necessary to establish a diagnosis.

One of the best illustrations of the limitations of the x-ray is in the diagnosis of cancer of the stomach. Usually the presence of the tumor is easily ascertained. From the x-ray viewpoint, the lesion may seem to be operable but at surgery, will be found to be hopelessly inoperable due to the presence of metastasis to surrounding viscera and lymph nodes. The surgeon should learn that an x-ray report indicating an operable lesion simply means that the lesion appears to be resectable. One of the most frequent errors in gastro-intestinal diagnosis is the interpretation of a duodenal ulcer based on a deformed duodenal cap as seen on a single film. Never make a diagnosis of duodenal ulcer unless the deformity is seen at all times during the fluoroscopic study and is present on all films. These are but a few of the many pitfalls open to the roentgenologist and should put him on his guard lest he be mistaken.

The internist and the surgeon should accept the x-ray evidence as only a part of the completed data, correlating the roentgenological, the clinical, and the laboratory findings before attempting to make the final diagnosis.

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Above all else, the patient should have the benefit of a careful history and a thorough physical examination before an x-ray examination ·is undertaken. This will do away with many needless examinations.

BIOLOGICAL CONCEPTS IN PSYCHIATRY

THEIR MEANING AND SIGNIFICANCE

By Commander F. M. Harrison, Medical Corps, United States Navy

INTRODUCTION

Science is continually evoking a series of inventions that affect every phase of our daily lives. Time and distance alike diminish, and the very planets shrink to the measure of human hands. In addition to an increased knowledge of the physical world, which science has bestowed upon us, it has given us accurate information concerning the processes of life itself. Through the medium of biology, we have learned what sort of people we are, and how we may best exist in our novel surroundings. After all, this is what matters. Had we been presented with a new environment, without being told how to adjust ourselves to it, we should have known nothing of the perils that beset our path, and we should have gone rattling back into barbarism long ago. Biology represents, therefore, the magic wand that permitted us to escape the crushing power of dogma and superstition, and become a rationalistic race.

While biology has been of extreme benefit and value to mankind in general, we must investigate, through introspections, the mind of the individual, and study his mental conflicts, if we wish to penetrate into the real causes of the difficulties of life, for here are encountered numerous stumbling blocks to efficient adjustment. This is the field and province of psychology, a scientific discipline that gives us insight into how men know and think, how they reason and feel, and how they react under stress and strain. Supplementing the work of biology, the new genetic psychology has taught us the way in which we might all the more accurately deal with the many perplexing obstacles that confront us at every turn. It has accomplished this by emphasizing the driving power of the instincts, by tracing the genesis of impulses, by pointing out the forces that shape human character, and by paying specific attention to the biological needs of the organism at the psychological level.

The subjects of biology and psychology are coming nearer and nearer to occupy a common ground. These two sciences overlap to the extent that in the study of many problems it is almost impossible to determine where the one begins and the other ends. Each lends

its support to the facts that serve to elucidate the phenomena of the other order, and they are really the same science viewed from different aspects. In its broadest meaning, biology is inclusive of psychology, the humanities, and the social sciences, and it is in this sense that we shall use the term. Biology concerns itself with all of the mechanisms that the individual uses to bring about an adjustment with his surroundings. Hence, it is likewise interested in any nocuous agent or element, either exogenous or endogenous, which may set up a reaction within the organism and disturb the state of physical equilibrium in which it is accustomed to dwell.

In order to dominate their invironment, and to live in perfect harmony with the external world, organisms must be able to conquer constantly arising new problems and situations. In the lowest forms of animals, this adaptation is accomplished by physical and chemical reactions. In the higher types, the same physiological functions are at work in the process of adjustment, but in addition, the aid of a nervous system is brought into play. In the human organism, psychological and social attributes are added. Viewing the psyche as the means by which the individual as a whole is adjusted to his surroundings, it follows that diseases of the mind, or the neuroses and the psychoses, inasmuch as they throw his adaptive responses out of gear, so to speak, will prevent him from reacting in an efficient manner to environmental conditions. This constitutes a problem that is thoroughly biological. It is also the subject matter of psychiatry. This specialty becomes, therefore, a medical branch of applied biology, and it should be studied as such.

The practicing physician has too often looked upon the new biological psychiatry as a subject, unattractive and obscure, difficult and abstruse, and as one with which he need have no immediate concern. If the surgeon and the internist, however, will but take the trouble to analyze the problems confronting them in the surgical and medical wards of hospitals, and in their own private offices and consulting rooms, they will find psychological factors of importance in a large proportion of their patients. Although it is cultivated as a separate discipline, psychiatry stands in close and intimate relation with internal medicine, and it must always represent an important chapter to the clinician. The internist will certainly fail in his work unless he is acquainted with the aims and methods of this speciality, and unless he is familiar with the various reaction types as exhibited in different individuals. At the same time, the psychiatrist can have become really expert only after a thorough training in internal medicine.

Many of the newer discoveries in medicine have been brought to light through the channels of biology. This latter science has also

been a potent factor in changing our conception of mental disease, and it has been responsible for many of the revolutionary advances in psychiatric thought in recent years. Indeed, a biological approach is fundamental to all of the clinical branches of medicine because it furnishes us with a standard of normal physical and mental activity. As a result of the emphasis now being placed on the study of man in biology, a more comprehensive survey and a more intelligent understanding of the human organism have been made possible. This is a fact of momentous importance to psychiatry, in particular, and to the practice of medicine in general. It occurred to me, therefore, that it might be of some interest and value at this time to very briefly review a few of the more basic concepts in biology which may be said to underlie an adequate grasp of the problems of psychiatry, and to point out, wherever possible, their significance to medicine.

STRUCTURE VERSUS FUNCTION

The morphologists, or structuralists, on the one hand, maintain that structure is the cause of function. They insist that the essential thing in development is the transformation of one structure into another, the functions occurring in the course of evolution being regarded as merely incidental phenomena. To them, all disorders that affect the body have a meaning only when they can be logically explained by a detectable alteration in structure. One reason for such an attitude, perhaps, is that the principal stages in the growth and differentiation of structures are better known, and they have been described in far greater detail, than in the case of functions. Then, too, the theory of organic evolution, introduced by Darwin in the nineteenth century, and an increased knowledge of the physics and chemistry of the body, achieved by a series of brilliant physiologists, as well as the discovery of the microbes and their relation to infection, tended very strongly to establish and reenforce this strictly mechanistic view of the individual organism.

The vitalists, or functionalists, on the other hand, claim that function determines structure. They teach that the various habits and activities of the organism produce corresponding changes in structure, this being the chief problem in evolution. They cite as justification for their position the fact that a great many functional distinctions are recognizable between organisms that are morphologically indistinguishable. It has also been noted that the autopsy table, and the highest powered microscopes, as well as other instruments of precision, have often failed to reveal structural changes where during life there was every reason to suspect their presence. In addition, the physiologists and chemists, the biologists and physicists, by applying the methods of their respective sciences to the study

of organ activity in man, have been able to demonstrate changes in function in many diseases where no alteration of structure has been visible. The formulation of a purely psychological conception of the neuroses by Freud, and the inevitable increase in the number of severe cases of psychogenic disorders with no organic basis during the last World War, helped still further to substantiate the claims of the vitalists for the primacy of function.

The only way in which this controversy can be settled is to trace the structures and functions of the mature organism, in all their bewildering complexities, back to their simpler beginnings, and study them in the process of becoming. This involves a knowledge of differentiation, which may be defined as the progressive change from the general to the special, or the setting aside of certain cells for specific work and duties, or the accumulation of function as structure. It will be impossible to give a detailed account of all of the phenomena of development here, because it is too extensive a subject. Nor can we even indicate the principal stages and phases in which the evolution of the more important groups of organs manifests itself, despite the fact that therein lies the answer to our problem.

Suffice it to say, according to more recent trends in biology, neither structure nor function precedes the other as cause precedes effect, but their growth, development, and evolution are contemporaneous, and they go hand in hand. In other words, as the organism is confronted with more intricate problems of adjustment, and as it comes into more intimate contact with its surroundings, new and more highly specialized structures are formed, with a progressively more complex differentiation of functions. In biology, therefore, structures and functions are never investigated separately, but the one is considered just as essential as the other in the study of any problem that affects the individual, especially disease. There is a growing tendency, however, to emphasize function, and very rightly so. New functions arise whenever the organism is faced with the need of more efficient means of conquering its environment. In order for the functions, thus developed, to be of maximum benefit to the individual, they must be stable and definite, fixed and stereotyped, and they must be structuralized, or laid down in permanent pathways. It is this necessity that brings about the formation of structures, which are the physical substrata of functions. In an ultimate analysis, structure is nothing but organized function. The elaboration of these biological principles in recent years has resulted in the building up of a concept of disease, particularly in psychiatry, that stresses function instead of structure. This new point of view has already supplemented, and it will eventually supplant, the old ideas of the structuralists.

The significance of this subject to medicine becomes apparent at once. It is simply that the internist and the surgeon must not permit

themselves to think exclusively in terms of either structure or function. They should give equal consideration to both. This has not been done previously as structures have been emphasized and functions neglected. The school of pathology founded by Virchow has left such an impression upon medicine that the modern physician continues to be obsessed with the feeling that he must discover a defect in structure in order to account for disease in human beings. All of his efforts at treatment are dominated by this point of view, and he is often amazed to find that certain forms of therapy, which he regards as being unsound and as having no relation to the case whatsoever, very frequently accomplish the desired results. Such an attitude needs to be corrected. The search for organic lesions is important, but it will never bring about a complete understanding of disease. A knowledge of the behavior activities and the reactions of the organism that follow an initial stimulus or fault is also necessary. This means that internal medicine, following the lead of psychiatry, must recognize frankly and completely the claim of function to a place of equal importance and reality with structure.

Functional disorders are spread thickly throughout each department of medicine and surgery, but they are particularly prevalent in the endocrine, gastro-intestinal, cardiac, gynecological, urological, and metabolic clinics. It has been conservatively estimated by numerous authorities, notably Strecker and Ebaugh (1), that functional disease constitutes from 60 to 70 percent of medical practice. In other words, a large majority of the patients seen in the dispensaries of our large hospitals, and in the consulting rooms of private practitioners, present symptoms and complaints for which no adequate organic basis can be found.

In spite of their frequency, however, these functional disturbances are commonly neglected, misunderstood, and improperly treated. They command interest only as long as they are considered to be diagnostic problems. As soon as it is discovered that the patient has "nothing the matter with him," as we have often heard it expressed, he is passed over lightly, no further attention is paid to him, and he is referred to the psychiatrist. From a technical standpoint, most of these cases come under the broad heading of the psycho-neuroses, but a great many of them do not. For practical purposes, as suggested by Peabody (2), the patient who has a functional disorder may merely be suffering from severe subjective sensations due to alterations in the physiological activities of one or more of the organs in the body. His symptoms may depend upon an increase or a decrease of a perfectly normal function, or simply upon his suddenly becoming aware or conscious of a wholly normal function that is usually not noticed. Or as McDougall (3) would

have it, functional disorders represent nothing but an ill-adjusted timing of the reactions of the various organs and an imbalance of their relations to one another. The ultimate causes of these disturbances of functions are to be found, not in any gross structural changes in the organs involved, but rather in the influences emanating from the intellectual and emotional life of the patient, which may affect in one way or another any portion of the body. To say that an individual has a neurosis, therefore, because no demonstrable pathology can be pinned on him, so to speak, is wrong and not even logical.

Functional disorders really belong to the field of general medicine. It is often extremely difficult to determine whether we are dealing with an organic disease or with a pure disturbance of function, and the differential diagnosis requires the broad training in the use of clinical and laboratory methods which forms the equipment of the internist. Then, too, the patients themselves very often fear the stigmata of any professional contact with a psychiatrist, and they prefer to go to their family physician. As a matter of fact, many of these cases can be helped by the general practitioner without the aid of highly specialized psychological technic, if he will but appreciate the significance of functional disturbances and interest himself in their treatment.

It should be borne in mind, of course, from what has already been said, that we are really not justified in drawing a hard and fast line between organic and functional disorders. The opposition between them does not rest on a sound basis. Organic diseases are invariably accompanied by altered functions, while it is probable that an unlimited microscopist could always discover corresponding changes in structure in purely functional disturbances. Function is, in a large measure, dependent upon structure, and vice versa, and disease will continue to be an enigma until a definite correlation between them is made. The internist will certainly expand his horizon and broaden his outlook if he concerns himself with the vital capacities of organs instead of with mere changes in structure, and if he adopts a functional concept of disease, as suggested by biology and psychiatry. Such an approach will do away with therapeutic nihilism, because treatment will then be directed towards improving function rather than to eliminating the anatomical changes produced by disease, which usually are permanent.

BODY AND MIND

The origin of the mind is a topic upon which there has been much speculation by philosophers and theologians. One of the very earliest hypotheses was that which is known as transmigration. This doctrine probably reached its greatest development in India, where it

formed an important part of the Buddhistic belief. It was also a part of the religion of ancient Egypt, and it was embodied in the writings of Pythagoras and Plato. According to this theory, the number of souls is a constant one; souls are neither made nor are they destroyed; but at birth a soul which had once tenanted another body enters the new body. The view was adopted later on that God creates a new soul for each body that is generated, and that every soul is thus a special divine creation. This has become the prevailing concept of the Christian Church, and is spoken of as creationism. Still another doctrine, which has been given the name of traducianism, taught that the souls of children are generated from the souls of parents as bodies are from bodies. This theory has been defended by certain modern theologians, but it has been formally condemned by others. Traducianism came much nearer to the present-day scientific ideas concerning the development of the mind than did any of the other doctrines. In all of these theories, the psyche, or the soul, or the mind, was regarded as an entirely separate entity, which inhabited the body during life, and which departed at the moment of death. They were all based on erroneous beliefs as to biological phenomena, and hence they did not hold.

In addition to the various theoretical ideas as to the origin of the mind, numerous conceptions of the relation between the higher mental functions and the physical processes underlying them have been introduced. A brief definition of each will suffice. The theory of epiphenomenalism holds that mental reactions are due to physical changes taking places in the neurones in much the same manner that machinery gives rise to noise when in motion. According to another view, mind and body are merely two aspects of a third reality, the nature of which has not yet been revealed to us. In the hypothesis known as psychophysical parallelism, the physic and physical processes occur as contemporaneous accompaniments of one another without any direct causal relation. The two series, physical and mental, run parallel, but there never was, nor can there be, any transition from the one to the other. The school of psychic monism regards the mind as the only reality, and believes that matter has no existence outside of consciousness. The animistic theory teaches that there is a nonmaterial agency in all living things that exerts an influence over their actions. These various conceptions amount to nothing more nor less than pure metaphysical speculation. They have no practical value, and they are of interest only from an academic point of view.

The only way in which we can gain any real insight into the nature of the mind, its relation to the body, and its development, is to study the psychical processes of all organisms from the lowest to the highest, as revealed by their activities, their reactions to stimuli,

and their general behavior under normal and experimental conditions. When this is done, the fact that the mind, as well as the body, develops out of the germ stands out in bold relief. The essential oneness of life holds true here as elewhere. A very excellent description of the evolution of the mind from its germinal bases has been given us by Conklin (4), and we can do no better than to briefly summarize his views on the subject.

One of the fundamental properties of all protoplasm is general irritability, or sensitivity, which is the capacity of responding to stimuli. In the course of development, general sensitivity becomes differential sensitivity, or the ability to respond differently to stimuli that differ in kind, quality, and degree. This in turn gives rise to various special senses and sensations. Such sensitivity is the basis of all psychic processes. All of the reactions of germ cells and of the lowest organisms are in the nature of reflexes and tropisms. From these simple mechanical responses develop the complex automatic movements involving nerve centers, the inherited instincts, and the acquired habits of the mature forms of higher animals. Protoplasm has the capacity of registering and storing up the effects of stimuli for a short time. This is termed organic memory. Out of this function arises the faculty of associative memory, or the power of nerve cells to preserve the effects of former stimuli, or experience, for much longer periods and in more varied combinations. By the gradual elimination of useless responses, and the preservation of the useful ones, the behavior of organisms comes to be purposeful and intelligent. All of the evidence points to the fact that human beings arrive at reason and intelligence by the same process of many trials and errors mixed in with a few successes, a remembering of these past experiences, and an application of them to entirely new conditions. Where several responses to a stimuli are possible, and where it has been learned that one response is more satisfactory than another, action may be limited to this particular response, not only by external compulsion, but also by the internal impulse of experience and intelligence. This is what is known as conscious choice or will. In spite of the frequent changes of the materials of which we are composed, our sense of identity remains undisturbed throughout life, it being dependent upon the continuity of individual organization, especially of the nervous system. Associated with this continuing sense of identity and developing out of it is the most complex of all psychic phenomena, or consciousness. The elements out of which it is formed are found in the germ cells, and by a long series of various combinations and transformations due to interactions with one another and with the environment, the fully developed condition arises. At the particular time the individual becomes aware of the effects of stimuli, he

experiences subjective phenomena, such as emotions, perceptions. judgment, imagination, and other psychological processes, which are usually included under the term "mental."

As a result of numerous investigations in biology, we now know that there is nowhere in the entire course of development a sudden appearance of psychical processes, but there is a gradual evolution of them from simpler and simpler beginnings. From the very start, every organism, no matter how far down the scale it may be, shows a differentiation into a head end and tail. In an elongated prone animal moving forwards, the head end of necessity comes first, most intimately, and most intensively into relationship with any change in the environment. The head end is naturally exposed to the operation of forces that differ a great deal from those to which the other portions are exposed, and hence it becomes decidedly different. The earlier acquisition of information concerning the outside world necessarily gives the head end exceptional opportunities for influencing the rest of the body. This predominance is still further accentuated by the development of the organs of special sense in the head region. In some very primitive and remote ancestor of the vast majority of animals and man, the front or head end develops out of all proportion to the other parts of the body, becomes enhanced in importance, and forms the great centralizing and coordinating organ, or brain. This latter constitutes a dynamic locus wherein are concentrated those activities to which later in the course of evolution the name of "mind" is given.

Utilizing the above biological principles, psychiatry teaches that the psyche is just as old as the soma, and that there is no more reason for supposing that the mind is supernaturally created than that the body is. In other words. just as the structures and functions of the body may be traced back to the simple and fundamental properties of the germ cells, so the characteristics of the mind may be found to exist in germinal protoplasm. The development of mental faculties runs parallel with the development of bodily structures. No fact in the realm of science is more certain or more significant than this, from both a practical and a philosophical point of view, and yet no fact is more generally disregarded. Body and mind belong to the same order of phenomena, and the old distinction that existed between them has disappeared entirely in the light of newly acquired knowledge in biology and psychiatry. This means that physicians must no longer think of the mind as something very mysterious and incomprehensible, and they must not regard it as being closed to anyone except the expert and special student, as most of them are inclined to do now.

A definition of mind is impossible. Mind is known only through its operations. We are conscious of our own minds from subjective

evidence within us. We realize that mind exists in other persons because they act in obedience to outward circumstances as we do ourselves under similar conditions. Mind is the medium through which the individual becomes aware of the many things that constitute his surroundings, and of the laws that govern them. It is that subtle something through which our feelings are stirred, and by means of which we act and think intelligently. Mind is an adaptive mechanism which coordinates and directs all of our reactions as a whole in an endeavor to push us along in such a manner that our own interests, as well as those of society, are served to the best advantage. The human psyche is the highest form of structural and functional integration that has so far been developed, and it represents the final answer of the organism to the increasing demands placed upon it by the complex environment.

As far as the relationship between body and mind is concerned, they are so closely interlinked that it is impossible to conceive of the one apart from the other. The natural operations and processes of the mind depend upon the relative integrity of the body, and vice versa. Mind is related to body, as function is to structure. Mind is not the cause of body, nor body the cause of mind, but both are inherent in one common individuality and organization. The problems that confront the psychologist are exactly the same as those with which the physiologist is concerned. In other words, body and mind must ultimately be described in similar terms.

UNITY OF THE ORGANISM

A great many opinions have been put forward as to just what is responsible for the unity of the organism and what accounts for the uniformity of its behavior. The so-called corpuscular theories postulate a multitude of specific material entities in one form or another, each of which is supposed to represent some characteristic of the organism, the latter presumably being the product of their combined and harmonious activity. These theories fail to take into consideration, however, the basis of the individuality of the hypothetical physiological units, and their orderly integration. They merely translate the problem into terms of the meta-miscroscopic anatomy of the organism, and they are fundamentally teleological and anthropomorphic in their implications. The vitalistic theories assume the existence of a non-mechanistic principle which controls and orders the physico-chemical factors to a definite end or purpose. This vital force, which has been called entelechy by a number of authorities, is entirely independent of physicochemical laws and is superior to them. It constructs the organism as a man would build a machine. These theories recognize and state more or less clearly the essential

problem instead of ignoring it completely, but they are frankly speculative and involve assumptions which are unwarranted. The organism has often been compared to a crystal. This has led to hypotheses which state that the laws underlying unity and order in the organic individual are the same as those governing the aggregation and arrangement of molecules. There is no optical or other evidence, however, for the crystalline character of protoplasm in general, and so these theories may be dismissed as being unsatisfactory.

Recent investigations have demonstrated that certain parts of the organism produce substances which are essential to the normal activity or structure of other parts. Many observers state that every organ in the body is an organ of chemical correlation, which means merely that it produces something which plays a role in making other parts what they are. The hypothesis has been advanced, on the basis of these facts, that these chemical correlations are primarily responsible for unity and order in the organism. It is quite likely that chemical correlation is a factor of very great importance in determining the character of events in the organic individual, but it does not give us the solution of the real problem of unity. Chemical correlations depend upon the production and transportation of specific substances within the organism. It is evident, therefore, that parts decidedly different, or an organization of some sort, must be already present in order to produce such substances. In other words, the individual must exist as such before chemical correlation is possible.

In this connection, the work of Child (5) is of monumental importance. He conducted a series of experiments, extending over a period of fifteen years, in which he studied and analyzed the processes of individuation in lower animals. As a result of his investigations, he reached the conclusion that the physiological individual comes into being because of the relationship that exists between protoplasm and its environment, and not because of any self-determined or inherent organization in the former. In other words, he has given us a dynamic conception of the foundation of unity and order in the organism. Let us summarize his views very briefly.

To begin with, he assumes a mass of protoplasm, which is morphologically and physiologically homogeneous and undifferentiated. If a stimulus in the environment is permitted to act upon some point of the surface of such an aggregate, the first result is an increase in metabolic rate in the region immediately affected. This is followed by an irradiation of a dynamic change throughout the protoplasm from the point of original contact. As the wave of activity spreads, it successively acts as an exciting factor. This process is

fundamentally a transmission, for it consists in the passage of energy, and not in the bodily transportation of substance. The transmitted excitation gradually decreases in degree and intensity, and in its ability to produce further changes, until finally it becomes inappreciable and dies out altogether. In other words, a decrement in effectiveness occurs in transmission. The metabolic rate is highest at the point of original excitation and slows down in direct proportion to the distance from the spot where the stimulus was first applied.

If the external factor acts only momentarily, the changes in the protoplasmic substratum are slight and last only a short time. If the stimulus, however, is long continued, or repeated often enough, or if its strength is increased, the irritability or reactive capacity of the protoplasm is quickened, and permanent changes in its structure occur. These changes are greatest at the point of origin, where the excitation is most intense, and decrease with increasing distance from this region. In other words, there is established what Child has termed a dynamic or metabolic gradient, which becomes the starting point of a permanent quantitative order in the living protoplasm. Such an order represents a physiological axis or the physiological individual in its simplest form. This first order to arise is the chief, or polar, or major axis, or the main gradient. Similar orders which are developed later determine minor axes or gradients, and on the basis of these the symmetry of the indivdual is perfected.

In a metabolic gradient a relation of dominance and subordination exists between the levels of the highest and the levels of lowest rate. This is a simple and necessary result of the differences in rate of reaction. The region of highest irritability, or rate of reaction, must control all regions of lower rate, because it reacts more rapidly and more intensely than other regions. Its greater irritability also determines that it shall react to some conditions which are not effective in other regions. Consequently, the excitations transmitted from the region of highest rate are more effective in determining the metabolic rate at other levels of the gradient than the changes transmitted from any other region. The region of highest irritability, or rate of reaction, is then a physiologically dominant region because it is the chief factor in maintaining the gradient after it is established. This dominant region of the gradient is relatively independent of other regions, while the latter are relatively subordinate to the former. In general, each level of the gradient dominates lower levels, and is in turn controlled by higher levels.

As a result of the constant interaction between the organism and its environment, certain substances begin to collect along the 'pathway of the main gradient. The nature and accumulation of these

substances is dependent upon their relative stability in relation to the metabolic rate of the particular part of the gradient where they are found. The substances which gather at each plane of the gradient must of necessity be of the same osmotic tension as the energy transmission at that level. In other words, the dynamic gradient is in a state of physico-chemical equilibrium. As a rule, only the most stable substances can accumulate in regions of higher metabolic rate, whole substances of less stability may exist where the rate is lower. It will thus be seen that qualitative differences in the different parts of the gradient arise, and that each level of the gradient is characterized by specific substances. This is the beginning of differentiation, which now proceeds in an orderly fashion very much as if there were underlying it a plan or scheme specific for each kind of individual. The region of highest metabolic rate becomes the apical area of the main gradient or the head end of the organism, while the region óf least activity is the basal portion and develops organs of attachment. The localization of parts with respect to the minor gradients is also definite and characteristic. An individual has many gradients, and each organ has a dominant gradient of its own and probably numerous subordinate ones. All of the dynamic forces of growth and development in the organism can be visualized as operating along the axes of these multitudinous gradients, the latter being held in precise and orderly organization because of mutual relations of dominance and dependence, and all of them in the last analysis being under the direct control of the region of highest metabolic rate in the main gradient, or the head end. Such are the theories of Child, which are based on scientific experimental data, and which account in an adequate way for the processes of integration in the individual.

We begin now to get some idea of just what we mean by unity of the organism, and what it stands for. We can best define this concept perhaps by stating that in biology structures and functions, body and mind, are considered to be inseparable. Each depends upon the other for existence, and anything that modifies the one must of necessity modify the other also. They all develop together from the germ in a manner that is normal and specific by progressive differentiation, and they are but different aspects of one and the same thing, namely, organization. The component elements of the organism are not thrown into place in a helter-skelter fashion, but they are slowly evolved under the dominance of a head end, which controls all of the subordinate axes and gradients of the body. The entire individual is a sharply defined biological unit, which cannot be divided into parts without altering their character and significance. The only justfication for dealing with these different constituents of

the organism as if they were separate entities lies in the increased effectiveness of such treatment from an academic point of view.

The lesson to be derived from this principle of the unity of the organism, as far as medicine is concerned, is that the mind cannot be kept out of any problem that affects the individual, especially disease. This is obviously fundamental in psychiatry, it is of equal importance in therapeutics, and it is often of the most profound significance to the surgeon and to the internist. Every sick person, no matter what the nature of the malady may be, shows some variation from his normal mental state. Scarcely a single patient who is critically ill, as in typhoid fever, pneumonia, erysipelas, influenza, or after a surgical operation, thinks and acts as he does in health. To put it differently, there is in every pathological condition, over and above the physical derangement present, a certain nervous and mental element, which varies in degree in different individuals, and which constitutes a more or less conspicuous part of the disease entitity. In other words, there is a mental aspect to every illness, whether medical or surgical. In mild disorders, this amounts to little more than a group of disagreeable feelings, which call for no special attention directed to their relief. In more serious diseases, however, the nervous and mental element may, and often does, become a very important factor in that it lowers the resistance of the patient, aggravates the organic pathology already present, and hinders recovery. In the language of White (6), "the psyche is the central station, the clearing house, so to speak, for all the activities of the body, and hence, every physical symptom must have its reverberation in the mind of the patient." Every morbid process, therefore, with which we deal, is in reality a psycho-physical problem. The psychical reacts on the physical, and the physical on the psychical. In diseases of the psychical life, the psychiatrist never dares to lose sight of the physical organism, because he knows that if he dwells too long upon the mysteries of a psychical unconscious he may forget that the body is ill. On the other hand, the internist must always take into consideration the psychological, as well as the somatic symptomatology, in the study and treatment of disease, if the latter is to be fully encompassed, and if our methods of total diagnosis are to be improved.

The fact that every organism, from the lowest to the highest, represents what might be termed a psychosomatic unity, as we have just seen, indicates that we have no right to separate body and mental disorders, and to say either internist or psychiatrist, which is commonly done in medical practice today. Always it should be somatic and psychic treatment at the same time, and in the proper dosage and relationship. This is what modern psychiatry insists

upon. Such an approach involves a complete study of every case, and requires not only a detailed physical examination, including all the necessary laboratory tests and special procedures, but also an estimate of the personality make-up of the patient. If no organic basis can be found for the symptoms which he presents, inquiry should then be made into marital conflicts, financial failures, religious difficulties, sorrows, disappointments, anxieties, and thwarted ambitions and ideals in social life. This can be done diplomatically without seeming to pry into his private affairs, and without attempting to delve into the unconscious, or to unearth buried sexual complexes. Having gained the confidence of his patient, the physician is then in a position to use drugs and diets at the same time with psychotherapy in the form of convincing reassurance and general reeducation. It is necessary, therefore, for all internists and surgeons to possess at least a working knowledge of the mechanisms at the psychological level, and to recognize that they are just as reasonable, and just as definitely determined, as the physical, chemical, and physiological reactions with which medicine has so long been familiar in its other departments.

ORGANISM AS A WHOLE

When the discovery of the cellular structure of plants and animals was announced to the world, it was heralded as an epoch-making event. And so it was. The cell was the smallest morphological unit exhibiting vital activities that science had so far been able to find. The tissues of the more highly developed creatures were simply regarded as an aggregation of cells. The organism was explained by the sum of the substances of which it was supposed to be composed and their products. The human individual was considered to be nothing more nor less than a constellation of different elements. It soon became evident, however, that the cellular theory did not adequately account for life phenomena. Consequently, the concept that the cause of the existence of every part of the living organism is contained in the whole was put forward, or we should say revived, inasmuch as it had already been made the subject matter of an extensive literature, even dating back to the ancients. This idea from biology, because it is essential to its purpose, has been particularly elaborated in the realm of psychiatry. In this specialty, therefore, the dynamic organism, moving about as it does in its environment, and bringing all of its machinery to the task of effecting its various complex adjustments, is looked upon as something more than, and different from, the mathematical sum of its cellular constituents. In other words, the organism is more than a being that is merely physical, concrete, and tangible. It is an integrated whole, which exhibits

many functions and reactions that are in addition to those that have so far been discovered in any of its component parts.

The important lesson to be derived from this principle of the organism as a whole is that we have no right to regard the body as being composed of a group or system of organs, each with a special function to perform, and each being a mere collection of cells, nothing more, nothing less. The anatomical elements of the body are not independent and autonomous, but they are related to the whole organism. In order to gain any knowledge of an organ and its functions, therefore, we must think of it, not as an isolated entity, but as an ensemble of relations. The various organs of the body function by virtue of their dependence upon one another, and upon the whole organism of which they are a part. Their activity is not due to any power inherent within their structure.

The failure to recognize the tremendous significance of the concept organism as a whole, together with the advances in scientific morphology, led rapidly to the partitioning of the body into various organs and systems. Intensive research around each of these anatomical subdivisions has opened up whole fields of professional endeavor. We have grown to look upon the diseases of the different organs as entities in themselves. Specialization in medical practice has been harmful in many respects, and it is essential to get away from too much of it. We need also to eliminate the gradually increasing tendency to consider diseased hearts and livers, and so forth, as organs for which the body provides a sort of test tube, and in the treatment of which the personality of the patient is irrelevant. A change in this attitude will eventually come about as a result of the newer emphasis on the importance of the whole to an understanding of the parts in all phases of biological research.

The cardiologist, the urologist, the gastro-enterologist, and other medical specialists, are certainly no longer justified in considering the organs and the diseases thereof in which they are primarily interested to the exclusion of the rest of the body. One need only to refer to disorders of the thyroid gland, for instance, to appreciate that disturbances in this organ are reflected in the circulatory system and other remote parts of the body. The effects of cardiac pathology are often manifested in the liver, kidneys, and lungs. The secretory processes of the various glands, the work of the heart, the rhythmical nature of the respiratory movements, the activation of the ureters and the bladder, the propulsion of the food through the gastro-intestinal tract, and the nutrition of the body as a whole, are all profoundly influenced by diseases of the cerebro-spinal nervous system. Acute infection often leads to febrile delirium arterial hyperten-

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sion and arteriosclerosis may produce certain forms of encephalopathy, and uremic poisoning frequently causes disturbances of consciousness. Examples of this sort could be multiplied, but even these few illustrate in a rough way the interdependence of all parts of the body. Internal medicine, following the teachings of psychiatry, must stress and emphasize the role which the anatomical and physiological units of structure, whatever they are, play in the whole economy, if it is to maintain its proper perspective, and not drift into too narrow a point of view concerning the human organism.

To know an organ and its diseases is the apparent aim of most medical specialists. The ultimate goal of the psychiatrist, however, who appreciates the full meaning of the concept organism as a whole, is deeper and more far-reaching than this. He attempts to understand the patient as a total human being, with conflicts as well as a heart, with emotions as well as tonsils, and with thwarted purposes as well as a gastro-intestinal tract. In other words, instead of being interested in the pathological changes in some particular portion of the body, he surveys the entire individual. This enables him to treat the patient from many angles instead of from the standpoint of his chief or major disease alone. The real secret of the success of many physicians is the thoroughness with which they grasp and apply the principle of the organism as a whole to the baffling problems which they are called upon to solve.

In order to fully comprehend and understand the nature of disease in our patients, we must take into consideration the complex whole which the interacting parts create. Disease is a manifestation of the physiological reaction of the organism to various nocuous elements in its environment. In other words, disease is a modality of organic activity, and like all organic activity, it is a reaction of the organism as a whole. From a biological point of view, therefore, disease represents, not the responses of separate organs, or partial reactions, but total reactions to the causative agent, whatever it might be. Strictly speaking, there is really no such thing as a local disease. All diseases are general in nature and affect the entire organism, but their principal manifestations may be more or less localized. The meaning and significance of these facts to internal medicine is that many chronic conditions of unknown etiology and pathogenesis may possibly be explained as reactions of the organism as a whole, or total reactions to long-continued stresses and strains, both from within and from without, the organic compensations and defenses of the tissues breaking down in certain directions, so that different organs become involved to a greater extent than others.

PSYCHOGENESIS

In all human beings there may be observed certain types of responses that are more or less closely allied to instinctive acts. These are the emotional reactions, which result from special kinds of stimuli affecting the entire organism. An emotional reaction on the part of a person, however, is not merely a physiological response to a stimulus. It is the reaction of an individual to a situation which impedes, facilitates, or stimulates some instinctive tendency. We recognize emotion in others by a characteristic behavior, and we are cognizant of physical changes occurring in ourselves when we are experiencing an affective state. The emotions, whether mild or strong, are always dependent upon, and accompanied by, alterations in the physiology of the body. There is a considerable mass of evidence, based on pathological and experimental lesions, that the thalamus is the great subcortical center for certain primitive forms of the emotions, as well as visceral sensations, and the feeling tones of pleasure and pain. These are given expression in muscular movement through the rubrospinal tract. The emotions serve to aid the body in undergoing the necessary changes for driving the organism into a state of activity. In other words, by means of the emotions, the attention of the organism becomes focused upon some particular point in its environment, so that its energies may be coordinated for a specific reaction. Moreover, the emotions intensify the marks made by experience, with the result that upon the repetition of a stimulus, a more perfect response will be evoked in the future. It will be seen, therefore, that the emotions are related to a phase of behavior, as well as to feeling, and that they are adaptive reactions. In this sense, they are of tremendous biological significance and importance.

At the beginning of this century, there was a deeply rooted opposition to the idea that the emotions could induce illness, either physical or mental. Such a thing was generally repugnant to the then current medical thought. It did not harmonize with the prevailing physicochemical theory of disease as it had been crystallized by the brilliant achievements of the clinicians of that period. This was in striking contrast to the readiness with which the discovery of etiology of general paresis was accepted by the medical profession. Due to the lessons derived from biology and psychology, however, and to the emphasis placed upon it by psychiatry, it is now being appreciated that a large proportion of all of the patients encountered by physicians in their practice present psychic factors and emotional conflicts of importance. These are capable of producing a great variety of functional disorders, as well as organic or structural changes in the different organs of the body. This is the problem of

psychogenesis, a fundamental psychobiological concept which demands scientific testing because of its far-reaching implications.

We are all more or less familiar with the role played by emotional states and conflicts in causing somatic disorders, and we see evidences of it almost daily in our routine ward rounds.   Increased flow of saliva and gastric juice, vomiting, and all kinds of dyspeptic symptoms, may be excited by the sight of some revolting agent. Fright and anxiety often produce acute diarrhea.   The influence of the emotions in the etiology of peptic ulcer has been emphasized over and over again.   Many cases of ulcerative and mucous colitis may be regarded simply as physiological expressions of some deep-seated emotional disorder.   The occurrence of attacks of bronchial asthma and biliary lithiasis is more or less conditioned by the emotional state acting through the autonomic nervous system.   The flushing of embarrassment, and the blanching of fear, is proof of the effect of these states upon the walls of the arteries.   Clinical and pathological studies and observations have brought to light the fact that the morbid manifestations of such an organic disease par excellence as angina pectoris appear to be controlled, to a certain extent at least, by the emotions.   Violent anger may sometimes play a part in seriously aggravating an already damaged heart, and in producing tachycardia, palpitation, premature beats, precordial distress, and other signs of disordered cardiac function.   Emotional shock, especially fear, quite often brings on a frank exophthalmic goitre. We note also the apparent effect of the emotions in the genesis and course of diabetes mellitus and arterial hypertension.   These examples and many others, too numerous to mention, furnish abundant proof that psychic factors must have a very definite effect on the physiology of the body.   If these emotional conflicts occur repeatedly, and if they dominate the life of the individual, it is logical to suppose that they might leave an imprint upon the tissues, and produce organic or structural changes.

It will be seen from the above, therefore, that it is highly important for all physicians to make, as a routine procedure, a definite inquiry into disturbing emotional factors in all individual histories, with the possible exception of the acute infections, as Favill (7) has suggested.   If this is done, it will frequently be found that the digestive disorders in a particular patient began at a time when he lost a huge sum of money, due to a bank failure, and that they have recurred whenever he has been in financial straits, or when there has been a marked fluctuation in the stock market.   Or it may be learned that a few years ago, upon arriving home from a business trip, a patient was informed of the death of a near relative from chronic myocarditis.   He was overcome by the shock of the news, developed an

attack of precordial pain, dyspnea,. palpitation, and tachycardia, and then promptly fainted. Consulting his physician, he was told that he probably had heart disease, but he was cautioned not to worry about it. For over a decade he has not even so much as mentioned it, but his symptoms have continued, he has greatly restricted all of his activities, and he has lived constantly with the fear that he might pass away suddenly. Or again, we may discover that the headaches, and the pains in the back, of which this man complains, made their appearance at a time when he first felt the pangs of domestic incompatibility, and they become pronounced and more acute whenever he has a dispute with his wife. These hidden emotions must be recognized if the proper rapport between the doctor and the patient is to be assured. In this connection, Stevenson (8) states that neglect of the emotional problems that are involved in the numerous complaints of the patient by ethical practitioners is today lending aid and comfort to the cultist, and is wasting a powerful instrument of treatment.

The average clinician very commonly approaches the consideration of pathological condition with far too little knowledge of their psychic antecedents. The successful physician, however, with a broad experience in the practice of medicine, knows that the varied emotional factors, which may affect the personal or domestic life of the patient, exert a tremendous influence on the etiology of disease. The causes of many conditions, seemingly due to organic visceral disease, may be found in psychic or environmental backgrounds. A properly cultivated appreciation of these facts, according to Stengel (9), is as necessary to the trained internist as is a knowledge of the biochemical or physiologic changes which accompany certain diseases. He feels that it is a part of the routine duty of the clinician to recognize and determine by appropriate tests these latter factors in disease without calling upon the chemists and physiologists to point them out. In the same sense, he believes that it is essential to the efficiency of the practicing physician that he should be alive to the emotional and psychic factors in disease without seeking the aid of the psychiatrist. To overlook psychological causes at an early stage is just as grave an error as to fail to recognize and diagnose an infective process or a surgical anomaly, a constitutional disorder, or a frank pneumonia.

INDIVIDUATION

Each organism has a personal quality which causes it to vary its action indefinitely, to change its form, to try endless adaptations to external conditions, to produce young which differ from each other and from the common ancestor, and to alter its shape so as to secure

the best possible adjustment to its surroundings. The traits and the characteristics, as well as all of the other variations, which living creatures take on, must always be in the direction of increased fitness, and those that hinder or incapacitate must be discarded. Those favorable peculiarities in individual specimens which enable them to better meet the struggle for existence will be developed from constant use. The eminently significant feature, however, is that in some way these changes are accumulated in the succession of generations, and new species, which are in a state of continuous alteration, appear on the earth. This is the biological process of individuation, which makes for increasing differentiation, not only in the race, but in the separate members thereof, and which renders each and every organism entirely distinct from all others.

People of the same age, sex, race, family, and social status, vary in every trait which so far has been measured or estimated. Individual differences, for instance, in stature, weight, strength of grip, endurance, pigment in skin and hair and eyes, and in resistance to disease, are common. We all vary greatly in our ability to concentrate attention. Even a superficial observation of human behavior reveals significant differences in the degree of initiative, originality, and emotional stability, which individuals manifest in a critical situation. Everywhere we turn we discover that a given stimulus fails to elicit exactly the same response from any two people. There is a difference in the kinds of moods which we allow to persist over long periods of time. People vary widely in the traits that go to make up the different temperaments, which appear in varying degrees, and in bewildering complexities and combinations, in each person. Two equally important factors unite to produce this infinite variety in the human race, namely, heredity and environment. These are interacting and interdependent, and it is impossible to determine where the influence of the one begins and the other ends.

Because of these individual differences and peculiarities, it follows that the reactions of each organism, especially to disease, will be extremely variable, and that the symptoms of the same pathological condition will be different in each individual. These facts have long been recognized in psychiatry. In this branch of medical science, therefore, we try to seek out the individual factors in disease, particularly as they express themselves at the psychological level, and by an understanding of them, we endeavor to work out something constructive in the life of the patient under our care. In other words, each person who seeks help is individualized. This is the very essence of psychiatry, and may be termed its point of view, inasmuch as it is the only specialty in medicine that stresses this attitude.

For a long time the internist has been studying disease, and treating it, without a sufficient appreciation of just how the individual who had the disease was reacting to it. This tendency needs to be corrected. The general aphorism in psychiatry, treat the patient, not the disease, may be applied with equal advantage to all branches of medicine. One or two examples of this principle will suffice. A patient who has heart disease may be disturbed much more by worry over his wife and children than he is by the dyspnea from which he suffers, and as a result of his brooding, he may develop a long train of neurotic symptoms. In such a case, a talk with an understanding physician, who tries to make the situation clear to him, and who then has the social service department investigate and take care of his home conditions, does more to help him and straighten him out than a book full of drugs or diets. Or as Ruggles (10) shows, the patient who is to undergo a radical operation for cancer of the breast, or for some other surgical condition, may be very much concerned over the probability of success, and she may be thinking of the subsequent deformity that may be produced. From the standpoint of the surgeon, the problem is the same as in many other cases he has had, but the whole procedure to the patient is most profound. Attention to her .peculiarities and personal reactions may prevent considerable shock, and bring about a favorable outcome. This is only an indication of what can be accomplished by treating the individual factors in disease. Neglect of them may result in the unsuccessful handling of the case.

CONCLUSION

In conclusion, let me reiterate that whatever fields we touch in medicine, persistently and inescapably, we find ourselves in the presence of problems that can only be approached in an intelligent manner from a psychobiological point of view. Exclusive somatic medicine, as we have already indicated, is fast disappearing from the scene, and there is a distinct drift noticeable to a conception of disease in which the sick person, as well as his individual organs, receives attention. The consideration of the patient himself should always dominate and surround the investigation of his affliction. When this is done, it is amazing how frequently the particular pathological disturbance with which he is suffering is found to belong irresistibly in the whole fabric of his personality. The medicine of the future, in addition to being concerned with the anatomical structures of the patient, must interest itself and include in its survey the important problems of human distress, social relationships, emotional maladjustments, and personality disorders of all types.. This will come about as a result of considering each individual as a psychosomatic

unit. Such an approach involves a knowledge of the salient factors of life, and its significance, which after all is the principal theme, to which disease is but a corollary, and establishes a philosophy upon which the practice of medicine will ultimately depend.

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SOME ENDOCRINE ASPECTS OF PERSONALITY

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The physical form of the body and the expression of that form which is called behavior, have been topics of interest since time immemorial. The aphorisms of Hippocrates are filled with allusions concerning the relationship of disease to body structure. Avicenna is said to have referred to trembling fingers and protruding eyes in nervous people. That the laity have recognized deviations peculiar to disease is manifest through the superstitions regarding disease in folklore (1).

It was recognized early in medical history that there were certain behavior patterns associated with types of disease; somnolence, lassitude, and delirium accompanied fever; men became unconscious from blows on their heads. Insanity, first considered as the devil's influence, was next thought due to lunar influences. Lombroso considered defects of personality a result of altered body structure. With the discovery of the effect of the precentral and postcentral gyri on motor activity, phrenology was born and an attempt was made to chart man's behavior through cranial bosses. It now remains for the newest and youngest branch of medicine to intrude into the

fascinating field of behavior and attempt to explain disorders of personality in the light of imbalanced glands.

Students of personality constantly refer to sexual and hunger drives as fundamental attributes of man. It is obvious, then, that those elements in man which create the reasons for those drives should be studied rather than their remote effects.

Innervating the glandular mechanisms of the body is the sympathetic nervous system, and it has been said the sympathetic nervous system is the keyboard upon which the endocrines play. Therefore, degrees of placidity and irritability, a tendency to excessive sleep, psychomotor tension, or the presence of a psychotic state can be considered as evidence of a hypofunctioning or hyperfunctioning gland.

THE PITUITARY

The pituitary gland has been referred to as the "master gland" because of the regulatory influence it has upon the development and function of several of the other glands. From the anterior lobe of the pituitary, the following hormones are produced: the growth hormone, gonadotropic, thryotropic hormone, adrenotropic, lactogenic, adrenal cortex stimulating hormone, diabetogenic (pancreatropic), a nitrogen metabolism regulating hormone, and a parathyrotropic hormone. Recently evidence has been brought forward to show the presence of a fraction regulating erythropoiesis and water balance.

The posterior lobe and/or the pars intermedia is responsible for the elaboration of pituitrin which has been fractionated into: pitocin, pitressin, intermedin, and a melanophoric hormone. It is possible this lobe shares in the working of the vegetative nervous system through its action on the parasympathetic nerves (2) (3) (4) (5).

Many of these factors are not well understood nor have many of these been fractionated or analyzed; however, clinical tests have shown their therapeutic importance and hinted at what the future holds in their further study.

The ancient religious-psychological concept that mind and body are two separate and distinct entities, has been discarded. It is now recognized as a functional psychosomatic unit. Abnormal function in any part of the body makes its influence felt on every other portion. Obviously, then, any gland which plays such a fundamental role as regulating hunger and sex drive, must, with any disturbance of activity, alter the total person.

We are, of course, aware that training, education, and experience will modify the nature of the conduct and personality so that no two persons with a similar pituitary disturbance will show identical

behavior; but close analysis of the behavior pattern will shown the same type of alteration.

Rather than discuss theoretical or little understood pluriglandular syndromes i. e., Simmond's cachexia, Laurence-Biedl syndrome, Schüller-Christian's disease, we shall limit our discussion to altered functions in which the clinical manifestations are reasonably clear-cut and evident. Predominately manifest in the hypofunctioning pituitary, is the syndrome, adiposogenitalis dystrophy (Froelich's syndrome). This is diagnosed by obesity which in the later stages may be excessive; a fatty hypertrophy of the male breast, slow genital growth, and disturbance of skeletal development. Their personality is typical and fills all literature. They are the Santa Clauses, the "Chunky," and "Fatty" in every gang. "Fat people are always jolly and will do anything you want to them to." Falstaff was probably of this type. Such children accept teasing and bullying with no show of aggression. They speak of their inability to stand up before others with absolute frankness which is not found in the eunuchoid coward. As adolescence approaches, inferiority becomes manifest, but even this is not of the aggressive, hostile type which lends itself to day dreams of wishful fancy, but rather, a gentle submissiveness to "a lot in life which they must bear." They have a tendency to day dream but their dreams are not colored with the forceful fancies and dynamic qualities of the normal sexual immature, but filled with the hazy fairy-like dreams of early childhood. With this condition is poor motor coordination; as the pituitary gland is unable to stimulate the adrenals there is overactivity of the parasympathetics resulting in high sugar tolerance, poor cardiac response, slow pulse rate, and the symptoms of general fatigue. Oddly enough, erection and its concomitant, masturbation, but without ejaculation, is frequently found (16).

In brief, the examiner must observe closely the breasts of the male, the girdle of fat about the pelvis, the hypodevelopment of the genitalia, general scantiness of hair, and feminine form of the pubic triangle. It may almost be taken as axiomatic that with the apex of the pubic triangle downwards, in an adult male there is present a hypofunction of the pituitary gland, an associated hypothyroidism, hypoadrenism and hypogonadism. Clinically, such people may show gentleness, generosity, and the submissive spirit, but in a twenty-year old boy with female hair distribution, fatty breasts and pelvis, such traits call for a searching examination into the function of the pituitary gland (7).

The hyperfunctioning pituitary gland is as yet little understood. Syndromes of sexual abnormality are hard to differentiate. Are the symptoms observed those of an increased sexual stimulation *per se*,

or, are they the result of an overactivity of the gonadotropic fraction of the pituitary gland?

Gigantism, said to be the result of an oversecretion of the pituitary growth hormone, causes general skeletal overgrowth of the long bones, visceral hypertrophy and glycosuria. In the relatively young giant, there is marked sexual precocity, hypertrichosis, great muscular development, and dynamic aggressiveness. However, if the stimulation continues, there is rapid gonadal atrophy, loss of strength, potency and mental power; the hair falls out, the cardiac muscle undergoes fatty infiltration and degeneration, and finally he succumbs to a worn out pituitary (16).

In gigantism, the pituitary supplies an oversecretion, stimulating the gonads and thyroid, and keeping the epiphysis open. If the pituitary, after maturity, as a result of adenoma, chemical, or circulatory changes, pours out the growth hormone, acromegaly results.

The symptoms of this disease, with the enlargement of the acral parts, genital hypofunction, joint pains, pressure symptoms, and headache, are relatively well understood. In the early part of the disease and before structural changes are manifest, there is keeness of mind, often amounting to genius, aggressiveness, and the will to achieve. But with progression of the disease, the intelligence becomes fogged, the alertness gives way to apathy and indifference, courage becomes inferiority, and the end finds the patient an irritable, vegetative shell.

The Thyroid Gland

Best understood of the endocrines is the thyroid gland. Goiter has traveled with man as he marched inwards from the sea, and the descriptions and symptoms of goiter are found in all literature. Very early in man's history, it was recognized that "sea weed pounded fine and eaten raw soothed the troubled spirit". That fish is a "brain food" is a classical aphorism.

Crile (8) believes from his studies on the phylogenetic development of the thyroid that the brain and thyroid gland have arisen together in the forward movement of evolution. He states; "Man came over the bridge of protoplasm with a large thyroid but a blank matrix in his brain. * * * Ontogeny takes the blank matrix and records on it the web of civilized man".

Phylogenetically, the thyroid is as old as man, manifesting itself before the cerebral cortex. The thyroid grew with our muscle mechanisms and need for a rapid and adaptive method of life. Mental mechanisms are much newer phenomena and while they may be channeled into behavior patterns they cannot, as Cryle states, change the phylogeny that gave rise to the large thyroid gland (9).

From this point of view there is a chance for conflict between thyroid activity and mental patterns. Wholey (10) alludes to this, stating that thyroid dysfunction, carries with it an involvement of the sympathetic nervous system. This thyro-sympathetic complication puts a peculiar stamp upon the personality of the individual. While Grave's syndrome seems generally associated with hyperactivity of the gland, hypothyroidism may point just as significantly to the Grave's mechanism. Deeply seated personality trends, such as those of the manic depressive or schizophrenic, may be ushered into clinical activity by thyroid involvement, whether or not it is associated with the Grave's complex.

Brown and Gildea (11), say there is a constitutional predisposition to hyperthyroidism which will implicate a sensitive thyroid gland. Such patients so delicately poised seem to suffer an extreme feeling of insecurity, a strong sense of dynamic responsibility and a tendency to turn the effects of emotional disturbance inwards. If the cause of an emotional instability is severe enough and lasting, it may precipitate active hyperplasia of the thyroid gland. Such personalities give definite clues for the recognition of such a condition or predisposition before the clinical picture may develop.

Boyd (12), in his analysis of etiology of hyperthyroidism says, "During life the thyroid is continually being acted upon by stimuli of various kinds, chemical, bacterial, and psychic which tend to induce hyperplasia. When the action of these ceases, involution sets in, and the involuted gland may again become the seat of hyperplasia only to be followed by involution."

The symptomatology of the hyperfunctioning thyroid gland varies in the sexes. The quality of the symptoms and their expression is not the same for the same basal metabolic rate. At the present time, all the attention is focused upon the remote effects of the hyperfunctioning thyroid and little or none on the actual cause of the disease. The clinician worries about the tachycardia, elevated basal metabolic rate, and altered blood chemistry; the psychiatrist concerns himself with psychomotor tension and irritability. The surgeon sees the disease as an adenoma that requires extirpation. All this appears at variance with the actual cause. Hyperthyroidism appears to be one symptom or a syndrome of psychosomatic maladjustment, and its therapy must be aimed at the causative factor. Boyd maintains the hyperplasia may be considered as a compensatory mechanism as a result of a pathological stimulus, and if such is the case, thyroidectomy, while giving some symptomatic improvement, is not the physiological cure (13).

With this concept of the psychosomatic character of the thyroid, early manifestations of personality defects can now be considered.

At the earliest manifestation of altered thyroid function, the symptoms would be those relative to the patient's external environment; there is a manifest change in his character and temperament as he feels his security is threatened. This causes a loss of poise, and, as a consequence, he tends to flee to someone stronger for protection. The intense irritability and the psychomotor tension which develop and which are so often considered the classical symptoms of the disease, are merely byproducts of the neurasthenic background of the patient. If these continue long enough, if the basic mental pattern is laid upon a delicate nervous system as a result of heredity or environment which is prone to imbalance, frank hyperthyroidism may develop. If the psychic trauma continues, the thyroid increases cortical metabolism, increasing the kinetic flow, and consequently in such cases it is not uncommon to find psychoses, maniacal, melancholic or paranoid states. It must be emphasized these are found where there is a hereditary predisposition to nervous imbalance.

Manifestations of nervousness, irritability, aprosexia, headache, insomnia, pressure in the head, hot flushes and undue fatigability— all the symptoms of the neurastheniac—in an individual who has formerly been stable but who has suffered repeated psychic strain or emotional fatigue point towards a developing hyperfunctioning thyroid by several years (9).

In severe myxedema, the nervous and mental manifestations are in direct contrast to those of a hyperfunctioning gland. The psyche of the classical cretin is heavy and listless, apathetic; and in the acquired form, this is the most distinguishing feature. The additional symptoms of thick skin, torpor, and dullness, are found later in the disease. The borderline cases, early hypofunctioning thyroid, are the ones that engage our attention.

The early hypothyroid individuals are usually nervous, manifesting the same quality of psychomotor tension as found in the hyperfunctioning gland. They may show extreme irritability, enuresis, emotional instability and fatigue. At this stage an increased basal metabolic rate is often found. The best means of diagnosis appears to be, at the present time, a determination of the blood cholesterol, which should be decreased in hyperthyroidism (14).

THE PARATHYROIDS

Excessive nerve irritability is a common complaint in practice. Irritability of any type should call for searching analysis of the blood to discover the extent of lowered diffusible or ionizable calcium. Where there is a mild hypofunctioning parathyroid, total blood calcium may be normal while the ionizable calcium will be lowered. At the same time, there is a hyperphosphatemia (14). Such lowered func-

tion, it is thought, bears the same relation to certain obscure condi-
tions as the thyroid bears to skin conditions and depressed states.
This hypofunctioning parathyroid may be the causal element in the
clinical entities such as spasmodic croup in children, pylorspasm,
mucous colitis, gastralgia, asthma, hay fever, allergy in general, or
unexplainable irritability.

Tetany is the advanced stage of hypofunctioning parathyroids; its
effects upon the personality are too well known for repetition.

Hyperfunction of the parathyroids is usually due to the presence
of adenoma and is characterized by the excessive mobilization of
calcium from the bones. From a personality point of view there
is nothing to describe.

THE ADRENALS

Hypoadrenia frequently follows most of the acute infections, is
concomitant with chronic infections, and as a rule, accompanies
autointoxication of nonbacterial origin. The principal symptoms
are: a sense of weakness and exhaustion, lack of ambition, and a
feeling of lassitude. The appetite is poor and the other symptoms
of vagotonia are: irritable bowels, hyperacidity, spastic constipa-
tion, perspiration, indefinite headaches, and hypotension.

Essentially, this is the same picture as that found in Addison's
disease, except that in this the symptoms are aggravated, and unless
the atrophy, tuberculosis, or neoplastic process is arrested, death
follows. In these cases the intellectual processes are dull and re-
tarded, the patient is apathetic and listless with severe emotional
depression and extreme irritability.

The literature dealing with hyperactivity of the adrenals is ample
but confusing. Neurocirculatory asthenia, as defined by Crile, is a
syndrome in which fatigue, shortness of breath, and neurocircula-
tory disturbances are the chief symptoms, and the pathologic state is
one of excessive stimulation of the adrenals and sympathetic nerv-
ous system. Fatigue, nervousness, and sometimes exhaustion are the
most frequently encountered symptoms. These patients wake in the
morning more tired than when they went to bed. They complain
chiefly of nervousness, endeavoring to convey their subjective sense
of uneasiness and excitement which is partly psychic and partly
physical. This type of personality is usually precocious, quick,
artistic, and often brilliant. However, as their condition progresses
they feel fatigued, uncertain, inferior, unstable, undependable, and
vacillating. The reason for this is obvious, for they are constantly
keyed up, responding extravagantly to every emotion they en-
counter.

Hyperfunction of the adrenal cortex results in precocious sexual
development, virilism, and hypertrichosis. The condition is met

with so infrequently in the adult male and the symptoms are then so manifest that there is nothing to describe from the standpoint of a defective personality. (3) (7).

THE GONADS

In view of the face that the development and continuance of the secondary sexual charactertistic, both somatic and psychic, are dependent upon the internal secretions of the sex glands and these secretions are connected with the stability of any individual, dysfunction will have far-reaching effects upon the total person.

In eunuchoidism, the testicular secretion, while not entirely absent, is deficient, resulting in certain anthropometric measurements and lack of certain secondary sexual changes too well known for enumeration here.

Heredity appears to be the most important predisposing factor in the causation of inadequate testicular function. In the adult, hypogonadism results in nervousness, flushing, and eventually results in a phlegmatic, even temperament. There appears to be an inferiority complex, ideas of persecution, and as with any abnormally functioning gland, irritability of the nervous system. However, these last symptoms appear when testicular function fails after maturity. It must be recalled that the testicle has a dual role; that of the manufacture, transport, and storage of spermatozoa, and the elaboration of testosterone. In this connection, it might be mentioned that alcohol, taken in excess over a long period of time, is apt to destroy the germ cells, rendering the person sterile, but apparently does not affect the Leydig cells which produce the male sex hormone.

The hyperfunctioning testicle results in the typical pyknic type, while the mentality may be above normal (16). In addition to the sexual precocity and hypertrichosis, there is concomitant nervousness, restlesness, discontent, and, in some cases, migraine or epilepsy. The temperature may be elevated, there is usually a fine tremor, constant tachycardia, and the intense psychomotor tension and other symptoms may resemble nongoitrous hyperthyroidism. In the mature male, there is a tendency to anger on slight provocation, hardness of personality, and unreasoning sexual drive which might amount to perversions (17).

The literature on the therapeutic effects of testosterone is ample justification of its value in treating the male climacteric (18) (19) (20) (21). The symptoms of psychic and organic corrosion present, as a result of the hypofunctioning testicle, are alleviated by testosterone propionate (22) (23) (24) (25) (26) (27).

In view of our scanty knowledge of the functions of the endocrines, every test which will enable us to arrive at a working diag-

nosis should be employed. Consequently, a sperm analysis should be run on all men who complain of weakness, lassitude, nervousness, or irritability. A hypofunctioning thyroid will make itself manifest in an oligospermia before it will show as a lowered basal metabolic rate.

In this brief discussion of personality defects on endocrine origin, I have purposely avoided the ovary of the female climacteric. Disturbance of the glands in early childhood are not truly expressive in alterations of the personality and those that are, are so marked that there is no further purpose in discussing them. Thymic hypertrophy, because it is not well understood, and the literature on the subject appears confusing, has been purposely avoided. The literature concerning the relationship of the hypothalamus to disorders of personality is vague and misleading. Those few workers in this field point to some clinical evidence which shows that in the hypothalamus are areas, damage to which causes disturbances in mood. In man they consist of manic-like reactions, and in animals, "sham rage" (28).

Laboratory procedures which should be carried out in all patients complaining of insomnia, irritability, restlessness, asthenia, fatigue, or psychomotor tension. While not diagnostic they will tend to show if the personality defects are a result of glandular imbalance, and they will point to type and character of therapy (29).

1. *Basal metabolism.*—
   This is elevated in:
   (a) Hyperthyroidism.
   (b) Pernicious anemia.
   (c) Leukemia.
   (d) Hyperpituitarism.
   (e) Early diabetes.
   (f) Cardiac decompensation and nephritis.
   This is lowered in:
   (a) Hypothyroidism.
   (b) Malnutrition.
   (c) Froelich's syndrome.
   (d) Addison's disease.
   (e) Healthy people with bradycardia.

2. *Blood potassium (normally 20 mgs. percent).*—
   This is increased in:
   (a) Tetany.
   (b) Adrenal deficiency.
   (c) Pneumonia and uremia.
   It is lowered in anemia.

3. *Calcium (normally 9–11 mgs. percent).*—
   This is increased in:
   (a) Hyperparathyroidism.
   (b) Hypothyroidism.
   (c) Paget's disease.
   (d) Arthritis deformans.
   (e) Acromegaly.

This is decreased in:
  (a) Hypoparathyroidism.
  (b) Hyperthyroidism.
  (c) Colitis.
  (d) Nephritis.

4. *Sperm analysis.*—
  Causes of azoospermia and oligospermia:
  (a) Local infectious diseases.
  (b) Abnormalities of testes and penis.
  (c) Hypothyroidism.
  (d) Hypopituitarism.
  (e) Testicular hypofunction.
  (f) Diabetes.

5. *Cholesterol.*—
  This is increased in:
  (a) Hypothyroidism.
  (b) Diabetes.
  (c) Nephritis.
  This is decreased in:
  (a) Hyperthyroidism.
  (b) Anemia.
  (c) Epileptic attacks.

From this brief and scanty review it follows then that any defect of personality, inherited or recently acquired, means a study of the endocrine balance of the individual. If a flyer should become nervous and tense, complains of insomnia and psychomotor tension, and there is evidence of an inherited neurotic family, the alert flight surgeon will make every effort to discover if this condition results from maladjusted endocrines or is a result of hereditary structural and physiological weakness of the nervous system.

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DETECTION OF THE NEUROPSYCHIATRICALLY UNFIT

By Lieutenant C. L. Wittson, Medical Corps, United States Naval Reserve; Lieutenant H. I. Harris, Medical Corps, United States Naval Reserve; and Lieutenant W. A. Hunt, United States Naval Reserve

The neuropsychiatric service of the Medical Department, United States Naval Training Station, at Newport, has for its object the early detection, for separation from the Naval Service, recruits who, by reason of psychiatric defects, would be a continual handicap to the Navy through their chronic inaptitude and inefficiency; or who, by breaking down at some critical moment, might seriously disrupt the functioning of their entire unit.

The early recognition of this problem led the Navy Department to formulate a general neuropsychiatric program for use at the various naval training stations to supplement the preliminary sifting by nonspecialists at the recruiting stations. This paper will outline the procedures developed at Newport for the detection of such recruits in accordance with the basic directives.

During 1940, at this training station, with no special facilities available for neuropsychiatric examination, 37 cases out of a total of 11,801 recruits were selected as neuropsychiatrically unfit. The disparity between this total and the number of cases that could be expected, on the basis of experience in the last war, is an indication of the need for the Navy's program. In December 1940, preliminary to the full development of the latter program, a psychiatrist was detailed to the naval training station. In January 1941 he was assigned to full time work in the psychiatric examination of recruits. During the first 5 months of his duty, 60 cases out of the total of 3,981 recruits were detected. These recruits were separated from the service by the then prevailing method of transfer to the United States Naval Hospital with subsequent medical survey. With the establishment, on May 20, 1941, of a complete neuropsychiatric staff, and a psychiatric board to expedite the elimination of the proven and potentially unfit and inapt, the number rose, in the following 6 weeks, to 71 of the total recruits examined. In July and August, with the problems of procedure and organization settled, a total of 113 cases out of the recruits were detected and eliminated either by inaptitude discharge, medical survey at the station, or, if protection for the patient and others was indicated, to the Naval Hospital. This development is set forth in table 1. A brief study of the rise in the number of cases detected and eliminated will reveal the results possible of attainment by coordinated effort.

TABLE 1.—*Neuropsychiatric cases at the Newport Naval Training Station*

	1940	Jan.– May 20, 1941	May 20– June 30, 1941	July, August, 1941
Total cases	37	60	71	113
Alcoholism			1	
Cerebral hemorrhage (birth)				1
Cerebrospinal syphilis		1	1	
Congenital encephalopathy				1
Constitutional psychopathic inferiority without psychosis	1	7	8	18
Constitutional psychopathic state, criminalism			1	2
Constitutional psychopathic state, emotional instability		1	1	6
Constitutional psychopathic state, inadequate personality		3	7	3
Constitutional psychopathic state, paranoid personality		1		1
Constitutional psychopathic state, pathological liar		1		
Constitutional psychopathic state, sexual psychopathy			2	1
Dementia praecox	1	10	4	3
Dementia praecox (preclinical)				4
D. U. mental observation	11			
Encephalitis, chronic				1
Enuresis	9	7	2	6

TABLE 1.—*Neuropsychiatric cases at the Newport Naval Training Station*—Con.

	1940	Jan.–May 20, 1941	May 20–June 30, 1941	July, August, 1941
Epilepsy	8	3	4	17
Hydrocephalus		1		
Mental deficiency, moron		2	16	13
Migraine		1		1
Narcolepsy	1			
Post traumatic syndrome			8	10
Progressive muscular dystrophy		1		
Psychoneurosis, anxiety neurosis	2	1	1	
Psychoneurosis, hysteria		3	1	
Psychoneurosis, neurasthenia	1			
Psychoneurosis, psychasthenia	1	2		
Psychoneurosis, situational				1
Psychoneurosis, unclassified	2	7	7	11
Psychosis, manic depressive		1	2	
Psychosis, manic depressive (preclinical)			1	
Somnambulism		3	2	8
Stammering			2	1
Tic, facial		2		

The Psychiatric Board has been of prime importance in accomplishing the directives formulated by the Navy Department. The board is composed of a line officer of long service experience, not below the rank of lieutenant commander; a medical officer, not below the rank of lieutenant commander; two psychiatrists, and one psychologist. The duties of this board are to consider such cases as are presented by the neuropsychiatric staff, and make recommendation to the commanding officer as to disposition. In those cases where separation from the service is recommended, and approved by the commanding officer, separation is accomplished by inaptitude discharge.

The neuropsychiatric staff at this station consists of two neuropsychiatrists, one psychologist, a social service staffed by the Red Cross, and clerical assistants. Each member of the staff has had previous specialized training. One of the neuropsychiatrists has specialized in psychiatry, the other in neurology; and the psychologist has had research as well as clinical experience. The staff has its own separate observation ward of 54 beds. It is an integral part of the medical department of the station and receives full cooperation from the selection department, the drill department, and the chaplain corps.

GENERAL PROCEDURE

The recruits are observed for gross abnormalities during the course of the physical examination. Each recruit is then examined privately by the members of the neuropsychiatric staff. The examination is facilitated by having the recruit naked which results in a 25 percent saving in time and minimizes evasive and untruthful answers. An average of 3 minutes per man is required for this examination. The time consumed, as well as the specific procedure followed, must vary according to the individual recruit. Direct or indirect questions bearing upon enuresis, sleep-walking, head injuries, and all forms of epilepsy are always included in the questions asked each man, together with a quick appraisal of his intelligence. These questions serve merely as a framework

for the examination, which depends primarily upon the clinical acumen of the examiner.

If positive indications of a neuropsychiatric disorder are found the recruit is sent to the neuropsychiatric ward for more detailed study and possible presentation to the Psychiatric Board. If the findings are equivocal, the man is sent to a company for 3 weeks "diagnostic" trial. In all instances where considered necessary, a medical social history is obtained from the recruit's home community.

If the recruit is outfitted for diagnostic trial he enters the company with no stigma. At the end of 3 weeks a questionnaire is sent to his company commander. Then the recruit is called in for another interview. At this time the examiner has available the company commander's report, the social history, and the original notes made 3 weeks before. If these are favorable, the recruit is permitted to continue with his company and his case is placed in the inactive file and no notation is made in the health record. If unfavorable, the recruit is admitted to the neuropsychiatric ward for detailed study. Such study includes all neurological, psychiatric, and psychological procedures as indicated.

There is no way at present of knowing how many potential neuropsychiatric casualties are not detected during the recruit reexamination. Some of these develop symptoms during their training period and are referred directly to the neuropsychiatric staff from their companies by either their company commander, the chaplain corps, or by other medical officers. At present such cases constitute less than 10 percent of the total number recommended for elimination.

When all examinations, tests, and corroborative letters have been assembled, the case is considered in conference by the neuropsychiatric staff and presented to the senior medical officer for final disposition. If the case clearly justifies inaptitude discharge it is prepared for presentation to the Psychiatric Board on a special form devised for this purpose. Cases in which the condition cannot be proved to have existed prior to enlistment, or cases in which the condition may have been aggravated by the period of service are presented to the local medical survey board. Patients in need of hospitalization are sent to the naval hospital.

It cannot be stressed too strongly that the work of the neuropsychiatric unit is closely correlated with that of the other departments of the training station for the common purpose of furnishing the Navy with well-trained and well-adjusted men. As compared with the usual clinical situation, the task of military selection demands certain fundamental changes in personal orientation. The most important of these is the primary necessity of considering the welfare of the organization rather than the welfare of the individual. The Navy is neither a therapeutic nor a custodial institution. It is a fighting organization in which every individual must be fit and efficient. The examiner must beware of his own humanitarian feelings toward the recruit, and render a perfectly objective answer to the question, "Is this man fit?" This problem is complicated further by a shortsighted, selfish tendency of some civilian physicians, families,

courts, and institutions to rid themselves of problem cases by wishing them off on the military services.

Over all the work of the examiner hangs the ever present demand for speed. The normal flow of recruits through the receiving unit cannot be interrupted. It is also necessary to eliminate the unfit recruit quickly once he is detected. Every extra day that the man remains in service is an expense to the Navy, makes the establishment of the pre-service etiology of his disorder more difficult, increases the possible future pension difficulties of the Government, and retards the training of the other recruits in his company. The detection of an unfit recruit during the recruit reexamination, rather than later when he has been assigned to a company, results in the considerable saving of the cost of outfitting him. Moreover, if the nature of the recruit's difficulty is such as to be aggravated by service conditions, it is to his advantage to separate him as quickly as possible.

Fortunately, there are other aspects of the task that alleviate the difficulties introduced by this necessity for speed. The task of military selection requires only the proof of the existence of some disorder. It is not necessary to consider the problem of therapy. The simple determination of the presence or absence of medical disorders or personality characteristics that would unfit the recruit for naval service is the sole task of the examiner.

The limiting of the problem to answering the question of fitness for service reduces the range within which accurate judgments must be made. We are interested merely in fitness, not in the question of how fit or unfit the subject may be. This is illustrated by considering the problem of intelligence. We wish to know whether or not the man's intelligence is above the minimum set by naval requirements. If he is above this minimum, it is unimportant to the examiner to differentiate further, say between normal and superior intelligence, unless this latter determination is needed to shed light upon other disorders of the personality. The determination of the various grades of normal and superior intelligence is handled by the selection department as part of the general program of personnel selection for special training. This reduces the demands upon the examiner as well as upon the objective instruments he may use. A test that will differentiate accurately at the critical level will be useful, whether or not it will differentiate accurately over the entire range of the phenomenon in question.

In examining the recruits, it is necessary for the examiner to be continually on the *qui vive*, using every bit of clinical intuition that he possesses. There is no substitute in the examining procedure for clinical experience. Even where objective measures are used the results must be considered in relation to all the other findings. Behavior that may appear indicative of psychopathic personality often

turns out to be of an environmentally determined, transitory nature when it is considered in relation to the individual's total personality and history.

Indirect questions are more fruitful than direct ones. Often a boy who will deny having "gone on the road" when questioned about it directly, will reveal the fact if one begins with the innocuous question, "Have you traveled much?" A positive answer to this can then be followed by the direct and revealing, "How did you go?" The examiner must be ready at all times to follow up any hints he may receive, and to change his course of questioning as special circumstances require.

Where tests are used, as in the investigation of intelligence or personality characteristics, these tests must be brief and should be readily scored and evaluated at the moment. They should also be designed as clinical, diagnostic situations which yield direct observations of the recruit's behavior, as well as a statistical measure. In a later publication the authors will present a battery of tests designed for these requirements.

With borderline cases a period of observation upon the psychiatric ward is extremely valuable. Confinement for several days upon a hospital ward is often effective in bringing out latent personality difficulties. It also gives a chance for close observation of the subject in the varied personal and social routine of ward life.

It is not the purpose of this paper to discuss in detail the various clinical entities that are encountered. A few outstanding problems, however, are worthy of brief comment.

Many potential epileptics in the age group with which we have to deal have yet to have their first attack, or are unaware of nocturnal seizures they may be having. Such cases are obviously missed at recruit reexamination, but some have their first seizure during the training period and are thereupon eliminated. To what extent old brain injury with few or no residuals will unfit the individual to endure the shock of heavy gunfire has yet to be determined. It would appear to constitute, however, a *locus minoris resistentiae* for the stress of combat duty.

On the psychiatric side, the youthfulness of the recruits, with its attendant emotional lability, raises the problem of differentiating between normal adolescent upset and true abnormal behavior. At the 17- to 18-year-old level psychoses are usually larval in character. The frank schizophrenia encountered in the next decade is seldom seen. One meets instead preclinical schizophrenia which is much more difficult to recognize. A form of nostalgia not hitherto reported has been studied by one of us (C. L. W.). This is marked by the absence of the usual overt symptoms and is referred to as "cryptic nostalgia." It has been said repeatedly that the psychopathic personal-

ity does not reveal itself when separated from its social adjustments. We have found that a high percentage of these individuals can be detected in the course of the 3-minute neuropsychiatric examination. In dealing with these personality disorders, we have found that no substitute (such as a fixed series of questions) can replace the flexible individual examination.

Finally, it must be pointed out that intelligence is not an isolated quantity but is closely integrated with the individual's other characteristics. Borderline intelligence cannot be evaluated by itself but must be related to the individual's total personality.

The types of military ineffectuals encountered at Newport group themselves into several major classes: the mental defectives who would be failures from the outset; the behavior problems who would sooner or later become sources of chronic irritation; the frank and preclinical psychotics who would be liabilities from the outset; and those with disease of the nervous system who are doomed to invalidism. All these constitute a financial burden of considerable magnitude to the Government. The thousands of such casualties from the last war have cost the Government from $30,000 to $35,000 each.

THE ELECTROCARDIOGRAM AFTER EXERCISE

A STANDARDIZED HEART FUNCTION TEST

By Lieutenant Commander Arthur M. Master, Medical Corps, United States Naval Reserve

Any additional test of myocardial function should be welcome to the physician's diagnostic armamentarium since myocardial impairment not infrequently exists in the presence of a normal physical examination and even when objective tests, such as the x-ray, fluoroscopy, and electrocardiogram, are negative. In such cases it is difficult to evaluate subjective symptoms, for example, precordial pain which may be associated with either organic or functional heart disease. The diagnostic value of a test utilizing changes in the electrocardiogram immediately after exercise has already been completely reviewed (1) (2) but we wish to emphasize the advisability of employing a standard amount of work, dependent upon the subject's age and weight (3). This is necessary because excessive exercise may produce certain changes in the electrocardiogram even in normal persons (1) (2). Only when the test is thus standardized by performing the test in hundreds of normal subjects is it possible to determine that certain changes do not occur in healthy persons and should be considered abnormal.

PROCEDURE

The exercise employed is based on the "two-step test" which consists of climbing up and down two steps, each 9 inches high, so that

one climb is 1½ feet above the ground. The number of ascents depends upon the subject's sex, age, and weight, and detailed tables for determining this have already been published by the author (4) (5), and permission has been obtained from the American Heart Journal to reproduce them here.

"TWO-STEP TEST" OF MYOCARDIAL FUNCTION

Standard number of ascents

MALES

Weight	Age 5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69
40-49	35	36											
50-59	33	35	32										
60-69	31	33	31										
70-79	28	32	30										
80-89	26	30	29	29	29	28	27	27	26	25	25	24	23
90-99	24	29	28	28	28	27	27	26	25	25	24	23	22
100-109	22	27	27	28	28	27	26	25	25	24	23	22	22
110-119	20	26	26	27	27	26	25	25	24	23	23	22	21
120-129	18	24	25	26	27	26	25	24	23	23	22	21	20
130-139	16	23	24	25	26	25	24	23	23	22	21	20	20
140-149		21	23	24	25	24	24	23	22	21	20	20	19
150-159		20	22	24	25	24	23	22	21	20	20	19	18
160-169		18	21	23	24	23	22	22	21	20	19	18	18
170-179			20	22	23	23	22	21	20	19	18	18	17
180-189			19	21	23	22	21	20	19	19	18	17	16
190-199			18	20	22	21	21	20	19	18	17	16	15
200-209				19	21	21	20	19	18	17	16	16	15
210-219				18	21	20	19	18	17	17	16	15	14
220-229				17	20	20	19	18	17	16	15	14	13

FEMALES

Weight	Age 5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69
40-49	35	35	33										
50-59	33	33	32										
60-69	31	32	30										
70-79	28	30	29										
80-89	26	28	28	28	28	27	26	24	23	22	21	21	20
90-99	24	27	26	27	26	25	24	23	22	22	21	20	19
100-109	22	25	25	26	26	25	24	23	22	21	20	19	18
110-119	20	23	23	25	25	24	23	22	21	20	19	18	18
120-129	18	22	22	24	24	23	22	21	20	19	19	18	17
130-139	16	20	20	23	23	22	21	20	19	19	18	17	16
140-149		18	19	22	22	21	20	19	19	18	17	16	16
150-159		17	17	21	20	20	19	19	18	17	16	16	15
160-169		15	16	20	19	19	18	18	17	16	16	15	14
170-179		13	14	19	18	18	17	17	16	16	15	14	13
180-189			13	18	17	17	17	16	16	15	14	14	13
190-199			12	17	16	16	16	15	15	14	13	13	12
200-209				16	15	15	15	14	14	13	13	12	11
210-219				15	14	14	14	13	13	13	12	11	11
220-229				14	13	13	13	13	12	12	11	11	10

The resting blood pressure and pulse rate are taken in the sitting or lying posture and are usually obtained within a few minutes. Readings of the blood pressure and pulse rate are repeated until two in succession are practically the same, i. e., no more than 2 mm. Hg. or 2 beats per minute apart, respectively. The patient then walks up one side of the steps and down the other, always turning toward the same side of the room before each ascent [1] and completing the required number of ascents in a minute and a half. Normally, 2 minutes after cessation of the exercise, the blood pressure and pulse rate return to within ten points of the resting figures. An electrocardiogram, including the three limb

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[1] This necessitates a change in direction at each turn and prevents giddiness with its resulting artificial changes in the blood pressure and pulse rate.

leads and the chest, or fourth lead, is taken before the exercise is begun and is repeated immediately after its completion as well as 3 and 8 minutes later. Using the P–R level as a control, depression of the RS–T segment beyond ½ mm. indicates a positive test, i. e., an abnormal response, and does not occur normally. A change from an upright T-wave to an isoelectric (flat) or inverted T-wave is also an abnormal reaction. If the test, performed in 1½ minutes with the required number of trips as obtained in the table is negative, a second test, consisting of twice the standard number of trips should be made in 3 minutes, but this second test should not be performed for at least 1 hour later or the next day. Our usual method of procedure is to combine the response of the blood pressure and pulse rate and the electrocardiogram in one procedure. Although this can be done by one person with considerable experience, it is simpler to have the assistance of a technician, corpsman, or nurse.

Figure 1 presents the electrocardiogram of a normal man; all four leads are essentially negative. The electrocardiogram remains unchanged immediately after the required 21 trips as well as 3 minutes and 8 minutes later.

In figure 2 are shown the electrocardiograms of a patient suffering from an anginal syndrome due to coronary artery disease who had sustained an acute coronary occlusion previously. The four leads of the control record are practically normal. The electrocardiogram taken immediately after 19 ascents discloses that the RS–T segment in leads I, II, and IV has become depressed relative to the P–R interval, the depression ranging from 1½ to 2 mm. Five minutes after completion of the exercise the electrocardiogram has returned to normal. The electrocardiographic changes were even more striking after a double number of trips performed in 3 minutes. These records are not shown. Despite the practically normal electrocardiogram at rest the appearance of S–T changes after exercise is definitely indicative of coronary insufficiency.

Although the changes in the electrocardiogram after exercise have been described previously (1) (2), we believe that this is the first time that the changes have been related to a standard amount of work. Using the latter, it has been shown that significant alterations do not occur in normal persons and, therefore, a positive test is definite indication of myocardial impairment. A negative test, however, does not rule out the latter, for when the myocardial function is good the test frequently is not positive in spite of the presence of cardiac disease.

The two-step test is practical and simple to perform. All of us are accustomed to climbing steps and the test is applicable to sedentary and active persons alike. In our experience there has been no danger of mishap to the patient in performing the test. Sometimes the patient complains of pain but this does not interfere with the results of the test (2). If the pain is severe, the exercise should be discontinued.
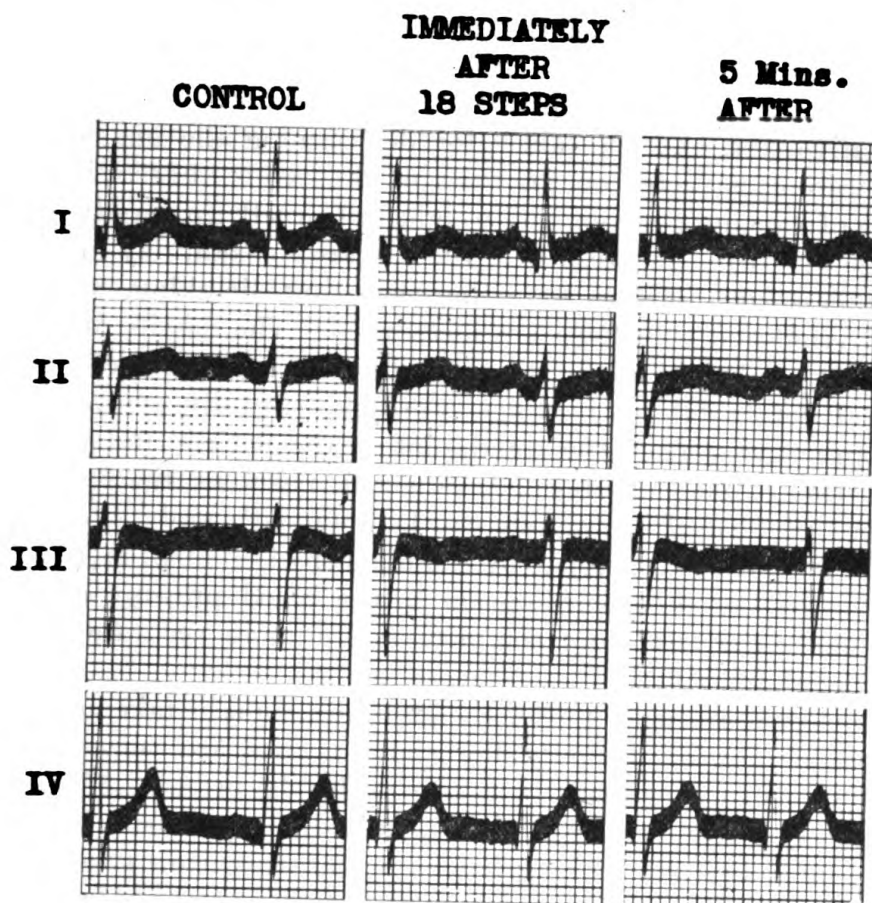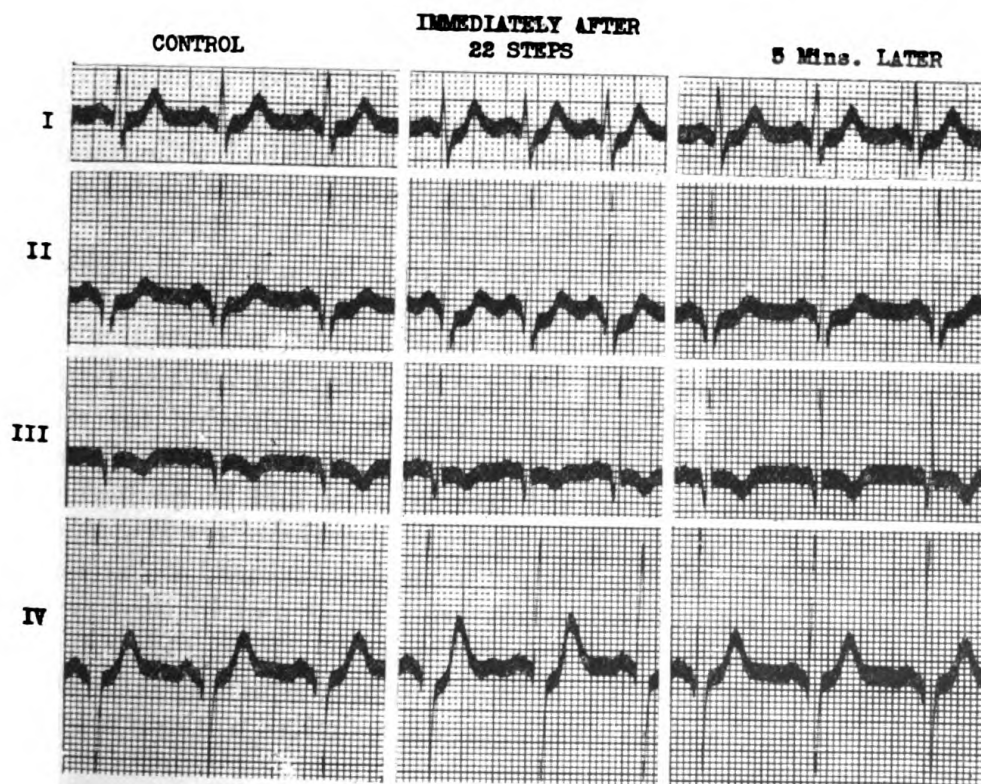
FIGURE 1.

FIGURE 2.

The value of the two-step test as a criterion of myocardial function, in the absence of pulmonary disease, has been established in many institutions and in private practice. It is a quantitative as well as a qualitative test, and the tables for determining the number of ascents were constructed on the basis of thousands of tests in normal people of varying age, sex, and weight at Cornell University Medical College (4) (5). The results of the test are constant day in and day out, unless such factors as eating, smoking, drinking, and drugs like thyroid and ephedrine are introduced. The details of the test, including the height of the steps, the duration of the exercise and the interval before taking readings, were all carefully evolved as the most practicable from the standpoint of the patient and physician. Furthermore, if one desires it for scientific purposes, the foot pounds of work performed per minute can be obtained merely by multiplying the weight of the subject by the number of climbs (4) (5). The addition of the electrocardiogram to the blood pressure and pulse rate makes the test more complete and a more accurate index of myocardial function.

The electrocardiogram after the exercise should be taken as quickly as possible for occasionally the abnormalities are very transient. The results of the test may be influenced by the presence of an upper respiratory infection, by digitalis, quinidine, ephedrin, adrenalin, thyroid, alcohol, or smoking before or eating within two hours of the exercise. Hence it would be wise to rule out these factors.

SUMMARY

A new test of heart function has been described consisting of an electrocardiogram after a definite amount of work, i. e., after the standard "two step" or an electrocardiogram after double the standard "two-step" exercise. It is a simple, practical test easy to perform. At times it may be the only objective evidence of heart disease.

The exertion must be limited to a definite amount for the patient's age, sex, and weight because excessive effort may produce electrocardiographic changes even in normal people.

For those in whom there is evidence or a suspicion of organic heart disease, for annual physical examinations, examination for retirement or "fitness," for elderly people and for those with abnormal electrocardiograms the standard "two step" should be used whereas the double "two step" should be performed on those in whom there is no cardiac dysfunction or in whom none is suspected, in the young, in those whose electrocardiograms are normal and in those whose tracings after the standard test are negative. Particularly is this double exertion indicated for military recruits, especially in aviation. The changes in the electrocardiogram are similar to those observed during anoxemia.

The more functional tests that can be made the more valuable is the final opinion as to the individual's cardiac function. Furthermore, the two tests, i. e., the blood pressure and pulse rate reaction to the standard "two step" and the electrocardiogram following this exercise can be performed at the same time.

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AN INK RECORDING ELECTROCARDIOGRAPH [1]

By Captain George W. Calver, Medical Corps, United States Navy

The reliance of physicians on electrocardiography is increasing with the extension of their knowledge of its value and dependability. In the arrhythmas it is about the only diagnostic aid upon which we can absolutely rely. With this knowledge there has come a demand for speedy reports or for methods giving immediate readable tracings.

In the past, in order to see what was being recorded, when bedside readings were desired, it has been necessary for the owner of a "string" type machine to also purchase a "mirror" type machine with a phosphorescent lag-belt visualizer of the type developed by Asher and Hoecker (1). To make a permanent record with either type of electrocardiograph it has been necessary to maintain a dark room, or some unsatisfactory substitute, with all its attendant delays and risks of improper processing, light-struck film, and other mishaps requiring repetition of tests. In most cases when tracings were technically unsatisfactory the first inkling the operator would have of this would be after developing the film, necessitating the recalling or revisiting of patients.

This office has investigated and experimented with several types of direct recording machines of various makes. Technical difficulties, lags, and mechanical faults so affected the tracings that none were considered reliable until the present apparatus was tested. That

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[1] Attending Physician, United States Capitol.

this is not an entirely new idea in cardiology is shown by the fact that Duchosal and Luthi (2), (3), (4) as well as Baumann (5) have reported the use of ink recorders in their work.

Like all new developments, the electrocardiograph ink recorder discussed in this article is probably not without its technical difficulties, but it certainly may be used advantageously in routine heart study. It operates on 110-volt alternating current (direct current may be converted, of course), is of the amplifier type, and uses inexpensive lined or unlined paper in place of film. It weighs 36 pounds at present, but can and should be reduced in both size and weight to enhance its portability. Electrical damping and standardization are controlled by the operator and both are recorded as a technical precaution. An ink tracing is taken which is immediately available for reading and is a permanent record. The pen does not come in direct contact with the paper. The ink flow is controlled by capillary means from a reservoir which is elevated or lowered to govern the width of the ink line. There are no lenses to adjust or strings to break, and when the radio tubes burn out they are easily replaced. The paper on which the electrocardiogram is recorded comes in 200-foot rolls, permitting long runs without rewinding or reloading a camera or fussing with film containers. Like ordinary paper, it does not need to be protected from light, no dark rooms or magazines being required, and it may be changed anywhere. The machine is simple of operation and when attached to the patient all four leads (1VF is the fourth) are taken without changing electrodes or wires, which avoids another possibility of error and confusion. 1VL and 1VR or any other combination may be taken if desired. At first, inexperienced operators seem to have a tendency to either over- or under-standardize this instrument, usually 1 millimeter or less, but when in those rare instances more accurate calculations are necessary, relative allowances can be made. The tracing is drawn in a narrower line than that of the average string shadow, but it is believed that this has more than sufficient advantages to offset whatever inconvenience may be entailed initially in becoming accustomed to it.

During the past 6 months, numerous comparative records have been made with this apparatus and other types of electrocardiographs. Minor differences in amplitude and degree of slurring have been noted, but it should be conceded that minor differences are always observed whenever different types, and even different makes of the same type, of equipment are used.

In the course of making these comparative tracings all the arrhythmias have been recorded, save ventricular fibrillation and ventricular tachycardia, as well as the various blocks and "coronaries," and, except for those inconsequential variations mentioned, none of which were misleading in making a positive diagnosis, the ink tracings
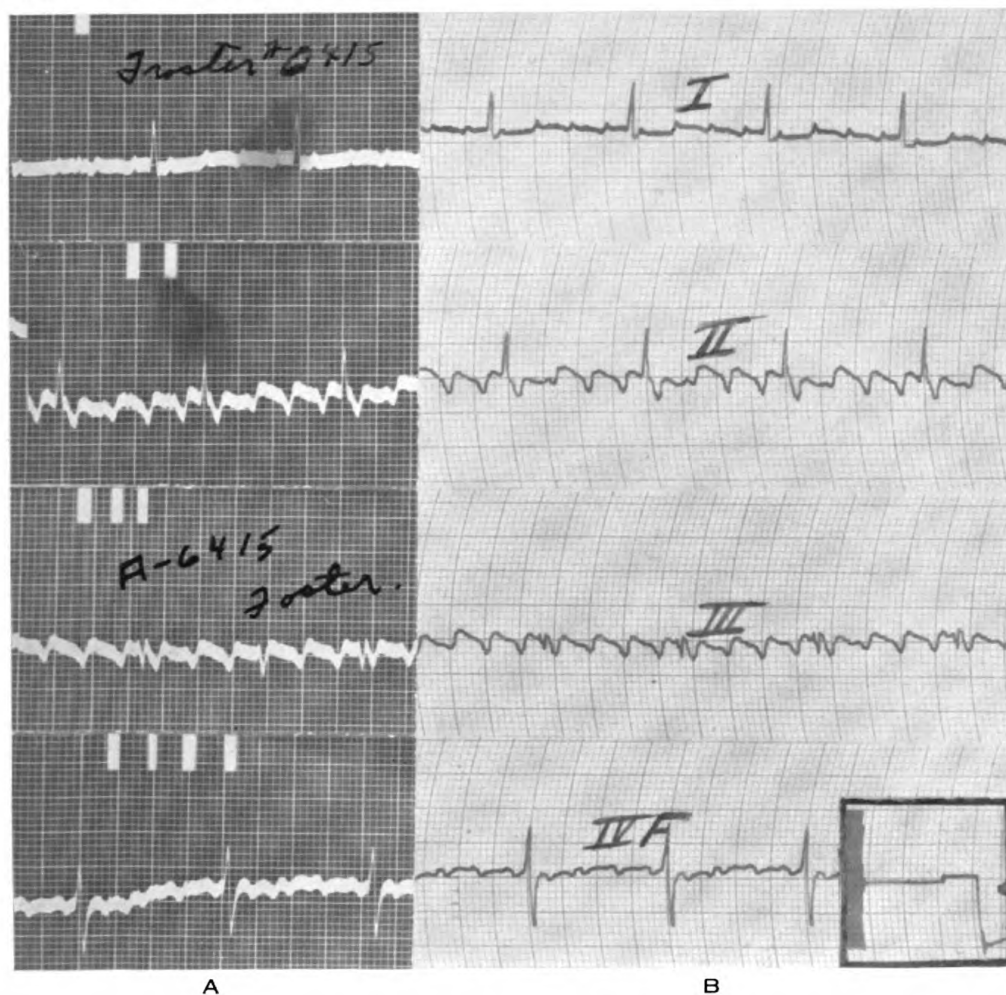
FIGURE 1.—AURICULAR FLUTTER. SHOWING COMPARISON OF THE TWO TYPES OF ELECTROCARDIOGRAPHS ON THE SAME PATIENT. A. PHOTOGRAPHIC ELEC-TROCARDIOGRAPH. B. INK RECORDED ELECTROCARDIOGRAPH.

and the conventional film electrocardiograms have been consistently essentially the same. In every case the ink tracing was recorded first; then, without changing the electrodes, the film tracing was taken.

Reference to figure 1, a case of auricular flutter, illustrates that the ink tracing demonstrates the arrhythmia at the bedside, without delay, and it is clearly as readable as the film type. Damping and standardization, done before the test, are shown in the separate section.

Figure 2 shows a case of auricular fibrillation with rapid ventricular rate. Standardization and damping are shown.

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SOME OBSERVATIONS ON THE CASUALTIES AT PEARL HARBOR

By I. S. Ravdin, M. D., and Perrin H. Long, M. D.[1]

It is quite possible that we shall look back on the experiences gained from the casualties which occurred during the raid on Pearl Harbor as opening a new era of surgical therapy. Much of the information which has come from the care of the men in the islands was already available. Here was the first large group of injured, treated in a small area in a brief space of time by American surgeons, many of whom had had training in the principles of surgical physiology and chemotherapy. The lessons we have learned from the care of the casualties have fortified the opinions of many surgeons. Others have been helped to learn that there are now available certain adjuncts of therapy of the greatest value which, if wisely used, will do much to reduce the morbidity and mortality of a wide variety of battle casualties.

EXTENSIVE SUPERFICIAL BURNS

During the raid on Pearl Harbor a large number of men received extensive "flash" burns. These were, in the main, of first and second degree. They involved, as a rule, the exposed body surfaces. Even a "skivy" shirt and shorts provided a high degree of protection for the area they covered. The lesson which can be learned from this is obvious.

Many of the men were covered with oil or grease. Further knowledge on the efficacy of various detergents which will remove the oil

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[1] The School of Medicine, University of Pennsylvania, Philadelphia, Pa.

or grease efficiently, and without too great pain, and without further injury to already damaged tissue, is required.

The value of the morphine "syrette" was acknowledged by everyone. Nothing is more important in the first-aid treatment of the burned patient than an adequate dose of morphine. If "syrettes" are not available, morphine can be dissolved in water so that a measured amount of the solution will deliver a known amount of the drug.

It is now generally agreed that the greatest danger during the first 48 hours following the burn is the development of shock. This condition results from a severe reduction of the plasma volume, and it can, in large part, be prevented or corrected by the administration of a blood substitute which will remain, at least for a period of time, in the blood vessels. The only harmless and at the same time efficient blood substitutes which are now available are plasma, serum, or normal human albumin.

Burned patients received plasma, and the medical officers at the United States Naval Hospital, Pearl Harbor, T. H., were exceedingly skillful in getting into veins which could not be seen or felt. The plasma was largely of the wet type and was provided by the Civilian Plasma Bank in Honolulu. This plasma bank had been functioning for some time under the able direction of Dr. Forrest Roy Pinkerton. It was found that where dried plasma was being used a corps of men should be trained to regenerate it, so that it would be available, in the regenerated state, for immediate use in the wards.

It should be remembered, that when large amounts of plasma are being lost from the circulation, as occurs in burns, that the intravenous administration of large amounts of physiological saline solution washes out still further amounts of the plasma protein from the blood vessels.

This has two harmful effects: '

(*a*) it tends to increase the shock;

(*b*) it intensifies the edema which interferes with the administration of large amounts of neutral sodium salts in hypoprotienemia and is known to increase the edema occurring at any given level of the plasma protein.

The Conference on Burns, National Research Council, has recently recommended that the amount of sodium chloride solution injected in any 24-hour period, for the first few days after the burn, should not exceed the amount of plasma which is administered during that period. This would appear to be an excellent suggestion.

Since the major function of the plasma protein under these conditions is to draw fluids into the blood vessels, the intravenous route is the only method of administration which should be used. The subcutaneous or intraperitoneal route, while permissible at times

when shock does not exist, may be hazardous in the presence of shock when additional fluid is drawn from the circulation, thus further reducing an already sorely depleted blood volume. A considerable number of the burned patients at Pearl Harbor developed edema because, in the early period of therapy, when attempts were being made to spread the large supplies of plasma as far as possible, physiological saline solution, with or without glucose, was also used to combat hemoconcentration.

The burned surfaces were tanned by a variety of methods: tannic acid jelly and solution, gentian violet, and the triple dye with or without silver nitrate. Where an inefficient tan was obtained, large amounts of plasma continued to be lost from the burned surfaces for some days following injury. After observing the extent to which serum can be lost from the surface of the burn we became convinced, that even with its disadvantages, some method of quickly providing an eschar was very desirable for extensively burned patients, especially when large numbers had to be treated simultaneously.

There were instances of necrosis of the fingers in patients whose hands had been tanned. There can be little doubt but that restriction of motion does occur, following recovery, where the hands are tanned, and where the original injury caused no mass lesion of the fingers.

The advantages of tanning, as we saw them, were:

(a) that it prevented the loss of that portion of the plasma volume which was otherwise lost to the exterior;

(b) that it reduced the amount of the immediate nursing care which was required;

(c) that it provided a relatively painless eschar; and

(d) that it permitted early evacuation of the patients with a minimum of discomfort.

The tan should not be removed (if infection does not take place) until it has spontaneously separated, as it always does in second degree burns. The premature removal of the tan leads to oozing surfaces and the likelihood of infection in a previously clean wound. If infection does not take place the eschar provides a protective envelope under which epithelization can take place.

The disadvantages of the method were:

(a) the high incidence of infection which occurred under the tan;

(b) the possibility that the agent used for promoting the tan further damaged the remaining islets of epithelium which must provide the nidus of subsequent epithelization.

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We do not believe that the liquid paraffin-sulfanilamide or sulfathiazole mixture will prove to be very helpful in the treatment of burns. The wide-meshed gauze, soaked with these mixtures, tended to stick to the burned surfaces, and the sulfonamides only too frequently "caked" on the suppurating, serum-encrusted wounds, so that they were not really serving the purpose of an active chemotherapeutic agent. Saline soaks, or these plus sulfanilamide crystals, proved to be beneficial in the presence of infection. In order to be most effective, the eschar overlying the area of suppuration should be removed, and the infected surface carefully cleansed, before applying the sulfanilamide and saline packs.

COMPOUND FRACTURES AND WOUNDS OF THE SOFT PARTS

The majority of compound fractures seen in the United States Naval Hospital at Pearl Harbor, T. H., involved the tibia or fibula or both. These were debrided, the fractures reduced, and the wound packed with crystaline sulfanilamide, which then was covered with vaseline gauze. Plaster casts were applied over this. The part then was x-rayed and the position of the fragments outlined with indelible pencil on the cast. This proved to be a very useful method for informing the medical personnel of the type of fracture and the position of the fragments following the evacuation of these men. The patients received sulfanilamide or sulfathiazole by mouth for from 4 to 10 days following the injury.

The men were in excellent shape following this method of treatment. The systemic reactions were slight and their morale excellent. Three lessons can be learned from this experience:

(*a*) infection can in large part be prevented;
(*b*) the bones in the fractures below the knee as a rule remain in good position;
(*c*) evacuation is simplified.

Seven weeks after injury the wounds were healing rapidly. In many instances there was clinical evidence of union. There were no instances of serious infection except in three patients with knee joint injury. The fragments had remained in good position. There was no evidence of osteomyelitis of the long bones. These achievements would not have been anticipated prior to the advent of sulfonamide therapy.

It might be supposed that since nearly all of the casualties occurred aboard ship serious infection should not have followed. Similar casualties which followed the raid on Hickam and Wheeler Fields were contaminated with the highly fertilized soil of those fields. Even in them infection was minimal. The combination of debridement and local and oral sulfonamide therapy should greatly reduce infection in compound fractures in the present war,

The fractures of the femur did not remain in a completely satisfactory position when treated by the plaster method. In these injuries some form of fixation will be necessary, although it may be possible, in many instances, to apply plaster after one of several methods of fixation has been applied. Following debridement, and local and oral sulfonamide therapy, nearly all of the wounds have remained clean. If this can be accomplished in future casualties, we need not concern ourselves too much about which of the methods of fixation may be adopted. The important thing is that the fragments be reduced so that a satisfactory functional result will be obtained.

The compound fractures of the upper extremity, were, in the main, treated by the closed plaster method. They remained in good shape and good position except for an occasional fracture of the humerus which required extension.

No instances of tetanus or gas bacillus infection occurred in these casualties. Even though the optimal conditions for the anaerobic infections did not exist, the complete absence of a verified case is worthy of recording.

In an occasional compound injury involving the knee joint, infection did take place. In one instance, this was associated with necrosis of the patella. It would seem, that where a joint is opened and infection takes place, no time should be lost in obtaining efficient, dependent drainage.

It was not possible to operate on all of the patients with soft part injuries, with or without fracture, within the first 6 hours following their injury. A number of the men with such injuries, especially those of the soft parts without fracture, were not operated on until long after the so-called "Golden Period" of therapy of 6 hours. In the main, the wounds were packed with crystalline sulfanilamide which remained in the wound until definitive therapy could be carried out. The nearly complete absence of infection in these wounds indicates clearly, that with the aid of sulfonamide therapy, the 6-hour period may, if necessary, be extended when the number of casualties is so large as to prevent early operation on all of them.

Infection resulted in a few wounds with soft-tissue injuries without fracture. In nearly every instance this was associated with the presence of a foreign body. In a few instances it is possible that infection occurred secondarily. In open wounds it is important to dust the injuries with crystalline sulfanilamide at each dressing until wound closure has been obtained.

AMPUTATIONS

While some of the amputations done in the naval hospitals had their flaps closed after the implantation of sulfanilamide, a number

were treated by the guillotine method. When the latter method was used, the end of the stump was frosted with crystalline sulfanilamide, and then covered with vaseline gauze. These were dressed at intervals from 3 to 5 days. In the Army, where more guillotine amputations were done, 7 weeks after injury nearly every stump treated by the open method had been revised, and of these, with a single exception, every one was tightly closed. This single exception was draining a few drops of serum. Nine weeks after injury nearly every man was being fitted for a temporary prosthesis. When one remembers the protracted suppuration of the amputation in the last war, one cannot help but be amazed at the results that have been obtained.

It was of interest to note, even though large amounts of various sulfonamides were used, locally and by mouth, that toxic reactions were rare. There was but a single instance of possible drug fever.

FREQUENCY OF TYPE DENTAL BRIDGE RESTORATIONS
REPORT ON 173 RESTORATIONS [1]

By Lieutenant Commander Ralph W. Malone, Dental Corps, United States Navy

Although many classifications on type dental bridge restorations may be found in the textbooks (1) (4) and dental periodicals (2) (3), it is difficult to find any based on numerical evaluations of actual cases constructed and being worn by the patients. For this reason it seemed appropriate to determine the type restoration most frequently constructed by a dental officer at a single naval dental activity. In this paper the naval dental activity considered was the Naval Dental School and the writer, the dental officer who constructed the bridges.

PROCEDURE

There were 173 restorations studied and classified as follow:
1. Fixed or removable type.
2. Position.
3. Type anchorage.
4. A numerically descriptive group (bridge units).

Of prime importance is that classification dealing with numbers of bridge units and the percentage in each group. Replacing one tooth where one anchorage and a rest is used, is considered a two-tooth replacement. Where two anchorages are used, replacing one tooth, the bridge is considered a three-tooth replacement. Thus when we refer to 3–4–5–6 tooth bridges, we infer that two of each adjective number are anchorages in the majority of cases.

FINDINGS

The following is an outline analysis of 173 dental bridges constructed at the Naval Dental School.

1. Fixed_____ 158
   Removable_____ 15
2. Anterior _____ 78
   Posterior _____ 80

(Removables were not classified as anterior or posterior)

3 and 4:
   ¾ crowns_____ 219
   Full cast crowns_____ 39
   MOD inlays_____ 29
   MODI inlays_____ 3
   MO inlays_____ 7
   DO inlays_____ 6
   Rest on inlays_____ 8
   Rest on tooth_____ 8
   Stress breakers_____ 7

Bridges according to numerical description and type anchorage

Bridge units	II	III	IV	V	VI	VII	VIII	Total
Anterior ¾ crown and rest on tooth	8							
Anterior ¾ crown and inlay rest	8	2						
Anterior ¾ crown and ¾ crown		16	13	6	23			
Anterior ¾ crown and MOD inlay			1					
Anterior-posterior ¾ crown and ¾ crown and ¾ crown and full crown							1	
Posterior ¾ crown and ¾ crown and MO inlay broken stress rest				1				
Posterior ¾ crown and ¾ crown		6	10					
Posterior ¾ crown and ¾ crown and ¾ crown			1					
Posterior ¾ crown and MOD inlay		15	2					
Posterior ¾ crown and MODI inlay			3					
Posterior ¾ crown and MOD inlay and full crown				1				
Posterior ¾ crown and full crown		10	6	5				
Posterior MOD inlay and full crown		2	3					
Posterior MO inlay and full crown			1					
Posterior full crown and full crown		3	1					
Posterior MOD inlay and MOD inlay		2						
Posterior MO inlay and DO inlay		2	1					
Posterior ¾ crown and MO inlay			1					
Posterior ¾ crown and MOD inlay broken stress rest		1						
Posterior MO inlay and DO inlay broken stress rest		1						
Posterior full crown and DO inlay broken stress rest		2						
Removable		3	7	4		1		
Number constructed	16	65	50	17	23	1	1	173
Percent constructed	9.2	37.5	28.9	9.8	13.3	0.6	0.6	

CONCLUSION

From a study of 173 dental bridge restorations it appears that those constructed for one tooth replacements were in the majority (46.7 percent.)

The three-quarter crown was most frequently used as a retainer.

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SULFATHIAZOLE PROPHYLAXIS IN PREVENTION OF GONOCOCCUS INFECTIONS

By Lieutenant Commander Edward F. Kline, Medical Corps, United States Navy, and Lieutenant T. Carlton Ryan, Medical Corps, United States Navy

The recent advance in the chemotherapeutic method of treatment of gonococcus infections with its great increase in percentages of cures and the amazing reduction in sick days has led us to the thought of prevention of this disease by these same agents. The use of sulfanilamide and sulfapyridine have been advocated for this purpose by some, but sulfathiazole, with its increased effectiveness, its relatively low toxicity, and ease of administration, was chosen as the drug of choice for our series of cases.

The exposures took place in various parts of the Philippine Islands over a period of approximately 8 months. The incidence of infective carriers naturally could not be determined. The presence of carriers, however, can be shown by the occurrence of 79 cases in patients not availing themselves of this prophylaxis during this same period of time.

The routine of treatment was to give 2 grams of sulfathiazole the morning following exposure and repeat 2 grams approximately 5 hours later. The results, as shown by the records very carefully kept and with no evidence of a source of error, surpassed all expectations. We have a record to date of 1,000 consecutive exposures where the prescribed treatment has been carried out, with one case of gonococcus infection of the urinary tract discovered. There have been two other cases of this infection of patients taking only one-half of the prescribed treatment, or 2 grams of sulfathiazole. Three cases of urethral discharges are recorded in this series, all of which took the prescribed course of prophylactic treatment. Each of these patients had used some form of local irrigation of chemical agents as a form of prophylaxis. The repeated examinations of smears failed to show a specific organism as a causative agent. The proper apparatus to run cultures on these discharges was not available, so we cannot conclude positively, but it is our impression that these cases were the result of improper local irrigation, due either to irritating concentrations or unsterile solutions.

The toxicity of the drug used has been a source of constant investigation because one serious reaction would nullify the procedure no matter how valuable its use as a prophylactic. In this series not one case was reported as showing any reaction which could possibly be attributed to sulfathiazole. The drug was taken by all patients with no evidence of gastro-intestinal disturbance. No change in daily routine was advised so that each continued the ordinary amount of physical activity and consumed the normal amount of fluids. No abnormal blood pictures were recorded and no evidence for continuing urinary studies was found.

As a summary, this series of cases showed an incidence of one-tenth of 1 percent of failure of the drug. The drug, in the small quantity that it is administered can be safely given without fear of toxic reaction, yet toxic manifestation must ever be watched for, to avoid a serious set back to its prophylactic use.

INTERESTING HIGHLIGHTS OF THE 1941 TULANE UNIVERSITY POSTGRADUATE MEDICAL CLINICS APPLICABLE TO MILITARY AND EMERGENCY SURGERY

By Lieutenant S. D. Murray, Medical Corps, United States Naval Reserve

During the 1941 Postgraduate Medical Clinics held at Tulane University in New Orleans, several interesting developments were presented which may be applied to Military and Emergency Surgery.

Of particular significance was the report on cotton thread as surgical sutures, which have been used in the Department of Surgery since 1939, long enough to provide a basis for definite opinion on the efficacy of this material. All other things being equal, this would seem a valuable addition to military surgical armamentarium in view of the ease with which it may be procured, transported and sterilized; but in addition to this, it seems to have definite advantages over other suture materials. The subject has previously been discussed in this journal,[1] but the experience of the New Orleans group is included herewith.

WOUND HEALING

Alton Ochsner, head of the Department of Surgery at Tulane discussed wound healing and deterrent factors. Along with infection, he considered low serum protein and vitamin C deficiency as being of prime importance. Individual variation in the ability to heal, and multiplicity of wounds are other considerations. He regards the type of suture used as being particularly significant. Cotton sutures

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[1] Logue, J. B., and Walsh, W. E.: Cotton Sutures, Use in General Surgery. United States NAVAL MEDICAL BULLETIN. 38 : 511–514, Oct. 1940.

are his choice, and this material has been used exclusively on his services at the Charity Hospital and Touro Infirmary in New Orleans since 1939.

Experimental investigation conducted by Ochsner in conjunction with Meade proved cotton to be less irritating to tissue than silk, linen, or catgut. This minimal amount of inflammation with low cellular and serum accumulations is distinctly in favor of the desirable "dry" type of healing. Fibroplasia appeared much earlier in their experiments where cotton was used than was the case with other suture materials.

Furthermore, cotton loses practically none of its strength after implantation in the tissues, and actually is stronger after being sterilized by heat up to 20 minutes.

The frictional coefficient of cotton is such that knots tied with this material have practically no tendency to slip. In addition, because of the conformation of its fibers, cotton loses little of its strength at the knot, a point at which catgut is notoriously weak. The natural flat twist of cotton fibers makes it ideal for thread-making, and the finished product shows little tendency to separate when cut, as is the case of silk. It is believed that the tendency towards sinus formation so often encountered by those using silk is due to an ingrowth of granulation tissue through the separated strands of component fibers.

When nonabsorbable sutures were first used, they were reserved for clean wounds only. Experimental evidence shows, however, that a wound will tolerate contamination much better if the less irritating nonabsorbable material is used for sutures. Furthermore, there is considerably less tendency towards dehiscence in the event infection follows. This has been borne out clinically, and no hesitation is now made in using cotton in contaminated cases such as perforated peptic ulcers, gunshot or stab wounds of the abdomen, etc. Tight closure is done, and a rubber dam drain left in place extending down to, but not through, the closed peritoneal incision.

Ordinary white spool cotton thread, obtainable at any dry-goods store, is used. Number 80 is employed for ties; and "quilting" cotton thread, corresponding to size 30, but with a smoother finish, is adaptable for sutures and ligatures on larger vessels.

Sterilization may be accomplished by boiling or autoclaving. Fifteen minutes has proved adequate.

The cost of cotton thread is low. Allowing 25 yards for each procedure, the price of that used per operation at the Charity Hospital is $0.0125, as compared with $0.933 for surgical silk, and $1.16 for catgut.

The disadvantage of spool cotton thread is the special technic it requires. It must be used in interrupted sutures, and the excess cut

away directly on the knot. They cannot be combined successfully with absorbable sutures in the same field. No mass ligatures can be taken, and small noncutting needles must be used with a minimal amount of tissues included in the sutures.

It is convenient to cut the sutures to 12-inch lengths, and employ several loaded needle-holders. The assistant holds all sutures until the approximation of each layer is complete. The sutures are then all tied, following which the excess is cut away, and closure of the next layer begun. Care is taken to make the cuts close to the knots in order to leave a minimal amount of foreign material in the wound.

Other interesting features of the clinics were preliminary reports by Caldwell and Cox on experimental gas bacillus infection in compound fractures, the report of Caldwell on chronic osteomelitis, Gage's treatment of acute cholecystitis, the description and application of the multiple tourniquet test for varicose veins as devised by Ochsner and Mahorner, and the care of wounds of the face, as presented by Neal Owens.

COMPOUND FRACTURES

Caldwell and Cox of the Department of Orthopedic Surgery at Tulane have in progress interesting experiments with gas bacillus organisms in compound fractures.

These investigators create a compound fracture in the guinea pig by making an incision exposing the outer aspect of the femur, and drilling two small holes to the narrow cavity. This obviates splinting the extremity.

The wound is then contaminated with macerated muscle and a lethal dose of actively growing Clostridium welchii. One hour is allowed for incubation.

All controls developed a gas gangrene with an average death time of approximately 27 hours.

Opening the wound at the end of 1 hour did not prevent the development of gas gangrene, but the animals lived for a longer period.

Debridgement at the end of 1 hour prevented the development of gas gangrene in a large percentage of the animals.

Zinc peroxide as a local dressing allowed the animals to live for a longer period, slowing down the development of gas gangrene, but not preventing it.

X-ray treatment proved of little value in preventing the development of gas gangrene.

Sulfonamide drugs placed in the wound at the end of 1 hour, followed by closure, did not prevent the development of gas gangrene, and most of the animals died as a result of gas gangrene.

Sulfonamide drugs systematically failed to prevent the disease.

Sulfonamide drugs placed in the wound at the time of the original contamination definitely slowed down the process, and when debridement was done 6 hours later, more sulfonamide drug implanted, and the wound closed, the majority of the animals survived.

Apparently, the immediate use of sulfonamide drugs in a compound fracture will allow the surgeon a greater margin of safety, permitting the debridement at a later time, and still prevent the occurrence of infection in a compound fracture.

The opinion reached thus far in the still unfinished experimental work is that the use of sulfonamide drugs in compound fractures at the earliest possible moment is extremely valuable, not because it will of itself prevent the development of local infection, but rather because it will allow greater latitude in the choice of time for debridement, and in many cases where debridement must be postponed, prevent infection which otherwise would have occurred.

In treating their clinical cases, Caldwell and Cox advise that sulfonamide crystals (sulfathiazole) be placed in the wound of compound fractures by the ambulance interns. When the patient reaches the hospital, a thorough cleansing is done in the operating room, plain white toilet soap and sterile water being used in lieu of chemical antiseptics. The surrounding skin is scrubbed with a brush, but not the wound itself. A sharp debridement follows, and the wound is finally washed with warm normal saline.

Sulfathiazole is then implanted in the wound, not more than 5 gm. being used on any patient, and primary closure done. If internal fixation is indicated, it is employed without hesitation. Approximately 60 percent of their 35 cases had internal fixation as emergency treatment. The plaster dressing is not disturbed for three weeks.

Postoperative treatment consists of sulfathiazole by mouth in moderate dosage for 10 days (45 gr. on the first postoperative day; the 90 gr. daily thereafter).

Three complications, none of which were serious, arose in their cases, all of which could be traced to errors in technic.

Contraindications to closure recognized by them are: (1) close-range shotgun wounds, (2) definite circulatory insufficiency, and (3) wounds over 10 hours old.

CHRONIC OSTEOMYELITIS

Caldwell reported a series of 28 cases of chronic osteomyelitis, all of which were draining pus, with 82 percent healing promptly.

Sulfathiazole is given preoperatively in moderate dosage (45 gr. the first day, and 90 gr. daily thereafter) for 4 days. The blood level is kept at approximately 5 mg. percent.

At operation, a thorough saucerization and sequestrectomy is done, and sulfathiazole, not exceeding 5 gm., in amount, is placed in the wound. Closure is done, and the dressing is not disturbed for three weeks.

Postoperatively, sulfathiazole is administered for 10 days in the same dosage as given before operation.

ACUTE CHOLECYSTITIS

Dr. Mims Gage, associate professor of surgery at Tulane, stressed the importance of early operation in cases of acute cholecystitis.

Gage considers obstruction as the causative factor in all cases, and he estimates that approximately 20 percent will develop gangrene and rupture unless surgery is done. Furthermore, there is little upon which to base a prediction of such a catastrophe. He regards a steady and increasing pain, in contradistinction to collicky and intermittent distress as a particularly ominous sign.

After emergency preoperative preparation such as hydration, shock therapy if necessary, sedation, etc., Gage removes the gallbladder through an oblique subcostal incision. He believes that this approach gives better exposure, facilitates closure, and produces a stronger wound.

Whereas in the past, he did choledochotomy in approximately one-fourth of his cases, Gage now explores well over half of the common ducts encountered. If the duct contains a stone, or if it is distended, it is opened, explored, and the sphincter of Oddi dilated. The duct is closed without drainage.

The abdominal incision is closed tightly with cotton sutures. If empyema of the gallbladder is encountered, a rubber dam drain is placed down to, but not through, the peritoneum. As has been repeatedly shown, the peritoneum is able to resist infection unless the contamination is overwhelming. Steinberg has been able to vaccinate the abdominal cavity against B. coli. This, however, does not obtain in the abdominal wall, and it is essential that an avenue for drainage be maintained when contamination occurs, to guard against abscess formation. An abdominal wall abscess, rupturing back into the celomic cavity, may well be overwhelming.

The results from the policy adopted by Gage are excellent. Convalescence is shortened considerably and fewer complications are encountered.

VARICOSE VEINS

Ochsner discussed the operation for ligation and injection of the internal saphenous vein.

The importance of determining the condition of valves in the communicating veins was stressed. This can be done by placing a tourni-

quet at various levels of the thigh, and having the patient walk rapidly back and forth across the room several times.

If the valves of the communicating veins are functioning properly, engorgement of the superficial veins of the leg will diminish when a tourniquet is placed just below the sapheno-femoral junction and the patient made to walk.

If the varicosities show little or no improvement, it is evident that valves in the communicating veins are incompetent, and blood is being forced from the deep to the superficial system at some point below the tourniquet. Consequently the constriction should be re-applied at lower levels until there is an improvement in appearance following exercise. This indicates that a double ligation will be necessary, one at the sapheno-femoral junction, and a second, usually made 2 weeks later, just below the point where the lower tourniquet produced the maximum improvement. As the majority of communicating veins are in the thigh, it is rare that the lower ligation has to be made below the knee.

Pain encountered during the tourniquet test indicates an inadequate deep venous system, and ligation of the superficial vessels are contraindicated.

Ochsner advocates the use of a longitudinal incision in order that the four large tributaries to the saphenous vein at its termination may be ligated. Failure to tie off these vessels, particularly the external superficial femoral, will result in a high incidence of recurrences. Others to be ligated are the superficial circumflex iliac, superficial epigastric, and external pudendal. There should be no difficulty in locating the saphenous vein in the groin, as it lies just medial to the femoral pulsation, which may be found even in the obese.

Ochsner stresses the importance of strict asepsis, as an infection predisposes to a broken thrombus and embolism. Ligatures should be tied above transfixion sutures in the proximal segment, in order that a propagating thrombus from the site of the injured intima be avoided. Also, the transection should be made as close as possible to the sapheno-femoral junction to avoid the formation of a blind pouch to favor stagnation, another feature favoring the occurrence of a thrombus.

The procedure is done under local analgesia, and the patient made to exercise beginning 1 hour following operation. They are instructed not to lie down during the remainder of the day, but to rest in a sitting position, and not too long at that, walking about frequently. This is designed to prevent the propagation of the thrombus to the deep circulation. Immediately after operation, the thigh is encased in an elastic adhesive bandage, and the leg, includ-

ing the foot down to the bases of the toes, in a plain elastic bandage continuous with that above. This is kept in place for 10 days.

Isolated and discrete varices are injected with 2 or 3 cubic centimeters of sodium morrhuate, and pressure applied.

WOUNDS OF THE FACE

Neal Owens discussed the emergency treatment of wounds, particularly those of the face. In cleansing wounds, he relies on the use of white toilet soap, sterile cotton and sterile water. He has found gauze sponges and tincture of green soap too irritating, and he has avoided the use of chemical antiseptics for some time on the theory that tissue damage is done if the solution is strong enough to be bactericidal. Physical cleansing is done for not less than 20 minutes, and, preferably, as long as half an hour.

Sharp debridement follows, and absolute hemostasis is obtained. Small (No. 80) cotton ligatures are used, with excess cut away directly on the knot.

Approximation is accomplished with buried cotton sutures (No. 80). It is important that small noncutting needles be used and that a minimum of tissue be included with the suture. For coaptation of the skin, 0000 silkworm gut on an atraumatic cutting needle is used. Inasmuch as cotton is nonelastic, and because knots tied with this material have no tendency to "give," cotton is not used for approximation of the integument, as frequently marks will be left on the skin as a result of the unpredictable swelling which follows all tissue damage.

For pressure dressings, Owens advocates the "cotton waste" which is used by mechanics. This had the advantages over the sea sponges previously employed in that it is more completely sterilized (autoclave), and it is considerably more economical. It should be teased apart before it is applied.

Owens made a plea for conservatism in treating injured parts which are cyanosed. These should be sacrificed only as a last resort, he states, inasmuch as even a small part of an ear or nose is of great benefit when a reconstruction is begun. A helpful adjunct suggested by him when there appears to be a deficient supply of blood is cribration with a bistoury. The venous blood may then be expressed from the part, and Owens regards the accumulation of venous blood as a prominent factor in retarding arterial circulation.

INTRAVENOUS ANESTHESIA IN NAVAL WAR SURGERY

By Lieutenant Commander E. M. Wade, Medical Corps, United States Navy

The recent rapid increase in the popularity of intravenous anesthesia has been based on true merit and the intelligent application

of this excellent procedure by our peacetime civilian and military anesthetists and surgeons. During the present period of national emergency it becomes necessary to give careful consideration to various new methods in the practice of surgery with a view to their adoption, with or without modification, or their rejection for use under war conditions.

Almost without exception, pentothal sodium has become the drug employed for intravenous anesthesia in this country. The technic of intermittent injection after appropriate preliminary medication has been fairly well standardized and was presented in some detail in two recent issues of the U. S. Naval Medical Bulletin (1) (2). For a detailed consideration of this subject, the reader is referred to these articles and their appended references.

For use in war surgery, intravenous anesthesia possesses certain very definite advantages. These include ease of administration, rapidity of induction and recovery, with a comparatively high degree of safety (3). An additional advantage is its freedom from danger of explosion. Due to the minimal amount of equipment necessary, it should be ideal for naval war surgery (4).

While studying the subject of shock in experimental animals, Seeley, Essex, and Mann (5) found that dogs could withstand the effect of trauma longer under sodium amytal anesthesia than under ether. Kendrick (6), in the Department of Surgical Physiology, Army Medical School, became interested in the subject and was able, with pentobarbital sodium, to corroborate the findings of Seeley and his associates. The factors which produce traumatic shock are known to operate for variable periods following the incident of initial trauma. One should be reassured in that the judicious use of an intravenous barbiturate, where an anesthetic is required, will in itself not unfavorably influence the final outcome.

Few of the known contraindications to this anesthetic will be encountered in the conditions which are known to exist on board a modern war ship after engagement. Constitutional factors such as old age, severe hepatic insufficiency, and severe cardiovascular disease are not likely to be encountered. Under ordinary service conditions, the rescue breathing apparatus, for the administration of oxygen inhalations in the event of cyanosis, will be available on board naval vessels. Even if this apparatus should not be readily obtainable, it should not be considered a contraindication for this type of anesthesia. To minimize the tendency to respiratory depression, 1 cubic centimeter of coramine (25 percent solution of pyridine betacarbonic acid diethylamide) may be included in each of 20 cubic centimeters of 2.5 percent pentothal sodium solution. The use of this anesthetic agent in a solution of this strength in-

creases the smoothness of induction and maintenance not possible when solutions of greater strength were used (7). The addition of this excellent stimulant to subsequent quantities of pentothal sodium solution will be dependent on a clinical appraisal of the patient's condition.

During a lull following a naval engagement, the medical officers may be confronted with a very large number of seriously injured persons. In their treatment, all measures which are both effective and time saving will be of utmost value. The emergency amputation of all or part of limbs, measures to control serious hemorrhage including ligation of large vessels, and the preliminary reduction of fractured long bones together with the application of plaster or other types of splinting may be done more rapidly by this type of anesthesia. Because of the previously described favorable characteristics of intravenous anesthesia, it is believed that it will prove of great value. This form of anesthesia does not appear to be specially suitable for injuries of the jaw or neck, although it continues to be advocated by some. Blood and mucus may cause physical obstruction of the air passages, or by local stimulation, may produce spasmodic closure of the glottis with a sudden cessation of respiration.

SUMMARY

Pentothal sodium should be available for intravenous anesthesia on board naval vessels with medical officers. Its fundamental advantages for use in naval war surgery include ease of administration, rapidity of induction and recovery, comparative safety, and the minimal amount of required equipment.

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PENTOTHAL SODIUM ANESTHESIA

By Lieutenant Commander Lawrence E. C. Joers, Medical Corps, United States Naval Reserve

Ever since the long-past age when a wooden mallet was the last word in anesthesia, surgeons have searched and patients have hoped for a perfect anesthetic. Remarkable advances have been made since that time in an effort to remove the mental and physical trauma from surgical operations. Surgeons of today have much to be thankful for as they recount the various advances from the days of drip chloroform, or ether, to the more pleasant and safer gas inductions, spinals, locals, and intravenous anesthetics.

In modern hospitals, with scientific equipment and reliable anesthetists, most of the popularly used anesthetics are reasonably safe; the induction is not unpleasant to the patient, and the necessary surgical state is readily achieved and maintained over the desired length of time without undue harm to the patient. This is usually sufficient to satisfy the average surgeon in a civilian hospital, but surgery in military organizations, especially in wartime, presents conditions that call for additional considerations in the use of anesthetics. Some of these will be presented and an attempt will be made to show that the intravenous anesthetic, pentothal sodium, can be used to the best advantage in most of these conditions.

The military surgeon, in time of war, will find that he will usually be called upon to work in a limited space, with a limited number of trained personnel, and without the advantages of the latest anesthetic machines. These machines are usually rather large and complicated to use, and many of the substances administered through them are inflammable and explosive. Such substances would increase greatly the danger on a battleship or in a field hospital during battle. Therefore, the anesthetic that most nearly approaches the ideal for use in military surgery must meet the following specifications: It must be relatively safe to the patient, noninflammable, nonexplosive, and simple to administer. Pentothal sodium meets these specifications and can be used in nearly every type of case.

The writer has been doing major surgery under pentothal sodium for over 2 years, and has administered the drug many times while other surgeons have operated. In some cases, such as brain tumors, gastric resections, or bone surgery, the drug has been administered for 3 or 4 hours without difficulty or apparent harm to the patient. In over 100 major cases, complications were noted in only 3. In 1 of these, the first 5 cc. of a 5-percent solution were given rapidly, after which the patient promptly stopped breathing, but responded after several minutes of artificial respiration and an ampule of coramine intravenously, and the operation was completed without

further difficulty. Another patient was an asthmatic. Soon after the onset of anesthesia, she began to cough and developed a most severe case of asthma. Pentothal was immediately stopped, and coramine and adrenalin were given, resulting in relief and uneventful recovery. The third complication was in a patient undergoing chest surgery for a bronchial fistula which had complicated a previous rib resection after empyema. His symptoms were similar to those of the asthmatic case, except that they subsided without treatment as soon as pentothal was stopped, and the operation was finished under local anesthetic.

There are several contraindications in the use of this drug. It should not be used in throat cases, in asthmatics or other dyspneic conditions, in cesarean sections, nor in cases with liver damage. It should be used cautiously in lung conditions and should not be used in cases that have been receiving sulfanilamide or related drugs until sufficient time has elapsed for these drugs to be eliminated from the body. The 5 percent solution is irritating to the tissues of the body so care must be taken that none escapes outside the vein; however, the writer has seen neither tissue sloughs nor abscesses resulting from this accident.

Experience has shown that pentothal sodium is destroyed rapidly in the body, and that the amount of drug needed depends greatly upon the preoperative preparation, and to a lesser degree, upon the size of the patient and the type of operation. The usual amount used, in average major cases under ideal circumstances, has been 1.25 to 1.5 grams of pentothal in a 5 percent solution, although 2.0 grams have frequently been used without apparent ill effects. It is considered of value to administer oxygen during the anesthetic, but appreciable benefit has not been noted either during or after surgery in these cases. It is important, however, to urge the patient to breath deeply as soon as he awakens.

When possible, a good preoperative night should be assured by the administration of nembutal 1½ grains at bedtime. One hour before operation the patient should be given nembutal 3 grains. If it is not advisable to give this orally, it may be given rectally. More rapid effect is obtained by perforating each end of the capsules before administration. Thirty minutes before operation, morphine sulphate ¼ grain and atropine 1/150 grain are given by hypodermic. During the operation, coramine or metrazol should be available for intravenous administration in case respiration should cease, and one ampule of coramine is given routinely as soon as surgery is completed.

The actual administration of pentothal sodium can be very simple and requires very little equipment. If necessary, it could be given, under the supervision of the surgeon, by one who has had very little

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training. There are several technics, as well as gadgets, to be used in administering the drug, but experience has shown the simplest to be the most satisfactory. A vein in the forearm opposite the side on which the surgeon will work, is the site of choice; however, any accessible vein may be used. The arm should be placed on an armboard at right angles to the patient's body and several turns of 2-inch gauze bandage is taken around the wrist. This is tied and then the wrist and hand are wrapped firmly to the board with a continuation of the bandage (fig. 1). Occasionally the patient will attempt to move the arm during the induction or during a light anesthesia, therefore, if possible, it is better to insert the needle somewhat distal to the antecubital fossa, as this will lessen the possibility of getting out of the vein.

For the actual administration, the following equipment and technic may be used. If the operation is going to be moderately long, it is more convenient to start an intravenous of 1,000 cc., of 5 percent glucose or normal saline first. A 21-gage needle 1½ inches long is a good size. This should be attached to a glass adaptor without flaws, which, in turn, should have attached a soft piece of rubber tubing 2½ inches long. Between this and the main tube from the drip attachment, a small glass Y is interposed, and to the free end of the Y another piece of soft rubber tubing about 4 inches long is attached, and this is connected with a 20 cc. syringe containing a 5 percent solution of pentothal sodium. An instrument table is placed at the same level as the patient's arm so that the syringe may rest upon it. This tray may also contain the necessary ampules of pentothal, a file for opening them, another 20 cc. syringe, and a large needle to aspirate the solution from the ampule, a medicine glass containing sterile water, alcohol sponges, and a small spring clamp. If the small glass Y is not available, a small needle may be attached to the rubber tubing opposite the 20 cc., syring, and this needle may be inserted into the main tube near its attachment to the needle that is in the vein. If, for any reason, one cannot or does not desire to use the intravenous drip, all the equipment that is needed is the syringe, 6 inches of the rubber tubing, the glass adaptor, and the 21-gage needle. More care must be taken under these conditions to prevent back flow of the blood from clotting the needle. This may be accomplished by applying the small, spring clamp to the rubber tubing whenever solution is not being injected.

To administer the drug, after the needle has been inserted and carefully secured to the arm with adhesive strips, the spring clamp is released and 2 or 3 cc. of the 5 percent solution is injected in about 15 seconds, then the injection is stopped for about 30 seconds. The patient is asked to count aloud, and, if properly prepared, will count to about 10 and then drop off to sleep. The injection is continued by giving 1½ to 2 cc. amounts at intervals sufficient to obtain and keep a condition of surgical anesthesia. These intervals lengthen as the anesthetic progresses. Usually about 7 cc. are needed to obtain the necessary anesthesia to begin operation, and additional amounts are injected whenever respirations deepen or there is a slight movement of the patient's fingers or toes. A most important thing is to introduce an airway as soon as the patient is asleep. This prevents the tongue from dropping back and obstructing breathing which always happens as soon as the patient relaxes.

When surgery is completed, the patient is returned to bed where he will begin to awaken in 15 or 20 minutes, after which he will go back to

FIGURE 1.—METHOD FOR THE ADMINISTRATION OF PENTOTHAL SODIUM
ANESTHESIA.

sleep for several hours. There is usually no postoperative vomiting or other complications, and this eliminates the need for constant attention except for the first few minutes after returning to bed.

SUMMARY

1. Pentothal sodium intravenous anesthesia is comparatively harmless when properly used, and has few contraindications.

2. With proper preoperative preparation of the patient, its action is rapid and effective for most types of surgery.

3. Its induction is not unpleasant to the patient and it is very simple to administer.

4. Very little equipment is needed and the solution could be administered by one not highly trained. The powdered drug comes in a small ampule and only a small amount of distilled water is needed to make the solution; therefore it is not cumbersome to handle.

5. The absence of postoperative vomiting and other complications helps to lessen the need for constant attention and thereby lessens the need for personnel.

FOOD POISONING

By Commander James F. Hays, Medical Corps, United States Navy

Food poisoning occasionally occurs in the Navy, and from time to time medical officers report instances where food, improperly prepared or handled, has been the cause of a great number of men being physically incapacitated from one to several days. At a critical time like the present, when the health of a ship's crew is most essential, an outbreak of food poisoning can very seriously interfere with the fighting efficiency of the ship. A great deal of time will necessarily have to be spent in the training of these men, especially those assigned to the cooks and galley force, seeing to it that these men are acquainted with the dangers incident to the improper handling and preparation of food. The medical officer, along with the supply officer, should see to it that all cooks and their assistants are carefully instructed in the proper way of handling and preparing food, and that the handling of food with the hands is to be avoided whenever possible. This should be done at frequent intervals because some men, at times, forget and become careless. No unauthorized person should be allowed in the galley at any time. Care should be exercised in the proper daily inspection of cooks, mess cooks, and food handlers, to see that they not only keep their clothes clean, but their bodies as well—especially their hands and fingernails—and that they are free from skin and intestinal disease. The scullery is a very important place in the ship

and should surely receive careful and minute daily inspection to see that the trays, dishes, and mess gear of all kinds, are being thoroughly washed and sterilized.

The older medical officers in the Navy are aware of these dangers and look for them. The younger medical officers, although aware of food poisoning, need to be constantly on the lookout for the danger of food infection in order to prevent a great number of men from being physically incapacitated and quickly put out of service. Therefore, the medical officers should constantly keep in mind the danger of food infection and food poisoning, and keep in close touch with the chief commissary steward to see that the proper inspections and proper supervision is given at all times to cooks and food handlers. They should be taught to watch carefully for spoiled food, some of which can be detected by its appearance and smell. Any can of food showing evidence of bulging, nail holes, or severe denting, should be discarded. All kinds of meat should be thawed in the chill box, or if this is not possible, note should be taken that it will not be permitted to stand a long time in the butcher shop before it is prepared for cooking. The galley, mess hall, and all places where food is handled and prepared, should be kept scrupulously clean and free from roaches, flies, and dirt. Hash and ham seem to be two foods which cause a great deal of food poisoning. Hash should be prepared and cooked just before it is to be consumed. Boiled ham should be served hot; but if it is to be served cold, it should be placed in the chill box shortly after boiling, and left there until it is time for it to be served.

The following account of food poisoning occurred aboard this ship.

Forty cases of food poisoning occurred aboard this ship on June 23 and 24, 1941, from eating creamed chicken. The onset was sudden in nature and the patients presenting themselves at sick call on the morning of June 24 were quite ill and needed immediate medical attention. The onset of symptoms in the first case was 7 hours, and the others ranged from that time until 39 hours after having eaten the infected food. The patients who developed symptoms sooner than the others, had a more rapid and prolonged illness. The ones presenting themselves 28 hours after having eaten the infected food, were not nearly so ill and were, in the majority of cases, treated as ambulatory patients and not admitted to the sick list. The symptoms were predominately gastrointestinal. The first symptom, in all patients, was a moderately severe griping abdominal pain, which in some cases was rather sudden in onset. Shortly after the onset of abdominal cramps, a troublesome and persistent diarrhea became the prominent symptom, which in 4 cases progressed in severity until there was blood in the stools. All patients, except those who were mildly affected, ran a temperature ranging from 99.4° to 104.2° F. The fever, however, did not last long and the temperature soon returned to normal. Headache, in those who ran a temperature of over 101° F., was invariably frontal in origin and rather severe. Headache of a minor degree was noted in only 2 patients whose temperature did not reach 101° F. Myasthenia was noted only in 5 patients, but general malaise and a tired feeling were present in all but 7 of the other cases.

Nausea was present in 14 cases, vomiting in 9 cases; this, however, was not a troublesome symptom as only 3 cases vomited more than 2 times.

A careful physical examination of each patient was made when he was admitted to the sick list and nothing characteristic was found other than abdominal tenderness. There was no rigidity nor localized tenderness in any part of the abdomen. The pulse rate in only two cases was over 104 beats per minute, the others ranging from 86 to 104 beats per minute; the pulse being equal, regular, and of good volume in all but one. In this case, the pulse rate was 116 beats per minute and was irregular due to numerous premature ventricular contractions, 10 per minute. The patient, being quite ill and toxic, was frightened and said that his heart felt like it was "jumping up and down," that he was sure he would smother to death and that he was losing his breath. Up until the present illness, he had never noticed this peculiar sensation in his chest. This pulse irregularity was, however, transitory, as it became regular after 6 hours from the time of his admission. There was nothing distinctive about the blood counts, urinalysis, examination of the stools, nor the blood pressure, except that in the majority of cases the diastolic blood pressure was low. This was checked with the recording in their health records and with the blood pressure after discharge, and it was found that the diastolic blood pressure had dropped on the average of 10 to 12 millimeters of mercury, there being little or no change in the systolic blood pressure. Of the patients admitted to the sick list, the average time of illness was three days.

All patients, after a physical examination and a diagnosis of food poisoning was made, received 1½ ounces of castor oil with 1 dram of camphorated tincture of opium. After 6 hours, this was followed by 1 dram of camphorated tincture of opium and 20 grains of bismuth subcarbonate, four times daily until the diarrhea and abdominal pain subsided. Liquids were ordered during the acute diarrheal stage.

After careful and detailed questioning of each patient who presented himself with gastro-enteritis, it was decided that the offending food was the creamed chicken that had been served for the noon meal on Sunday, June 22, as everyone had eaten of that dish. Three patients stated the chicken did not taste good to them, but the others had no complaint to make with the chicken nor the way it was prepared. Investigation showed that the chicken had been taken out of cold storage on Saturday afternoon, June 21, between 1400 and 1500, in a frozen condition, and had been left in the butcher shop all that day and night to thaw out. During the morning watch, the chickens had been prepared for cooking, cooked, and served for the noon meal. The chicken had been in the butcher shop, where it was quite warm, for 15 or 16 hours. During the preparation of the chickens, the cooks noted nothing unusual about the meat. None of the creamed chicken was available for bacteriologic examination as the remainder had been discarded before the patients had started to appear at the sick bay. The etiologic agent was unknown.

SUMMARY

Food poisoning in the Navy is something that medical officers should constantly keep in mind. They should see that proper supervision is constantly given to cooks, mess cooks, and food handlers. An outbreak of food poisoning of any proportion aboard a ship would seriously interfere with its fighting ability.

There were two interesting observations made in those affected by food poisoning in the case just reported. One was a precipitated attack of premature ventricular contractions due likely to toxemia, and the other was a distinct fall in the diastolic blood pressure in all but six of those men affected.

THE IMPORTANCE OF THE MILLER-ABBOTT TUBE IN INTESTINAL OBSTRUCTION

By Lieutenant Tully T. Blalock, Medical Corps, United States Navy

In recent literature much has been written of the use of the Miller-Abbott double lumen tube in the treatment of intestinal obstruction. Its use preoperatively and postoperatively has become a valuable adjunct to the surgical handling of this disorder. The suction combined with the gentle peristalsis stimulating effect of the inflated balloon is an improvement over unaided Wangensteen suction. In spite of the wide popularity of the Miller-Abbott tube, one of its important functions is frequently overlooked—that of allowing oral feedings of a liquid, high caloric diet to sustain the patient's strength, and maintain fluid and salt balance. What surgeon is not too painfully familiar with the picture of the obstructed patient with the ever-present intravenous saline bottle or the even more painful subcutaneous saline drip. With efficient suction in the small bowel, parenteral feedings can be cut to a minimum, or as in the following instances, omitted completely. In their place can be substituted a high caloric palatable liquid diet. This one factor is of tremendous value to the patient's morale, and the psychic effect alone is worth its trial.

Apart from the relief of distention and removing the source of the obstruction itself, the most important feature is the maintenance of fluid and salt balance which becomes uneven due to the persistent vomiting. No less important is sustaining the patient's natural combative ability by providing sufficient nutrition. The vicious cycle of vomiting and anorexia that so often accompanies intestinal obstruction soon places the patient in a dangerous nutritional state. Early in the obstruction there begins a disarrangement in the chloride and fluid balance which becomes rapidly worse unless treatment is begun immediately. In the face of the obstruction, feeding by mouth is impossible unless some means can be devised of removing that portion of the food that is not absorbed proximal to the obstructed point. This is the function of the Miller-Abbott tube. By directing its course to the obstructed loop of bowel, we are able to maintain suction on the proximal portion and remove all fluid that passes into it. Simple Wangensteen suction obviously cannot accomplish this as the suction tip very often lies in the stomach

or rarely in the first part of the duodenum. The Miller-Abbott tube, on the other hand, with its inflatable balloon, is capable of being carried through the small intestine to the point of obstruction. This enables it to remove the gas that is distending the proximal bowel as well as suck out any liquid that may reach its tip.

The technic of introducing the Miller-Abbott tube into the small intestine offers no particular difficulties. Although the use of the portable x-ray facilitates the procedure, it is by no means necessary. The patient is prepared 30 minutes prior to intubation with one-seventy-fifth grain of atropine sulfate subcutaneously. This is primarily to relax the pyloric sphincter. The tube is encased in crushed ice and the balloon deflated. The lumen leading to the balloon is then clamped tightly to prevent partial inflation. The patient is supported on his right side and the tube passed through the right nostril (or the mouth) until the 45 cm. marker is just visible. The patient is propped in this position with pillows and allowed to remain for 10 or 15 minutes. At the end of this time, a tight-fitting syringe is placed over the inflation nozzle and 10 cc. of air introduced into the balloon. The suction lumen is attached to a Wangensteen apparatus. The tube is further introduced until the 75 cm. marker reaches the nose. It is allowed to remain in this position for 10 or 15 minutes. At this time an x-ray of the abdomen may reveal the tip to be in the duodenum, or this fact can frequently be determined by attaching the syringe to the inflation nozzle and feeling the alternating negative and positive pressure exerted by peristaltic motion. This will be exhibited only if the plunger moves easily in the syringe. Once the tip reaches the duodenum, the balloon is inflated to 25 cc. of air and the inflation tube clamped tight. The tube is then introduced at the rate of 6 to 8 inches every 30 minutes. The change in the character of the material sucked out will often mark the progress of the tip.

Relief of distention is immediate and the patient feels much better physically and mentally. As soon as it is felt that the tip has reached a sufficient depth, oral feedings may be commenced, contributing tremendously to the patient's morale. Milk, soups, fruit juices, and water can be administered *ad libitum*.

CASE I

M. J., colored female, age 35, was admitted to the hospital on December 15, 1939, at which time a cauterization of the cervix, supracervical hysterectomy, bilateral salpingo-oophorectomy, and appendectomy were done. During the operation the peritoneum was contaminated on removing the appendix. On December 19, 1939, the patient developed an adynamic ileus. This was diagnosed by the presence of great abdominal distention, vomiting, fever, and complete cessation of bowel movements. The usual measures were attempted, i. e.: rectal tube, prostigmine methylsulfate, and Wangensteen suction. The distention was temporarily relieved, but increased on December 25, 1939. All

this time it was necessary to support the patient with intravenous saline and glucose almost continuously. She was given nothing by mouth. Her veins became so mutilated that it often took 30 minutes to successfully introduce a needle. On December 26, 1939, the Miller-Abbott tube was introduced, and 12 hours later the x-ray revealed the tip to be in the ileum. By December 29. 1939, the patient was taking a full liquid diet and the abdomen was completely deflated. On December 30, 1939, the tube emerged from the rectum and was removed via this route. The patient made an uneventful recovery, leaving the hospital on January 12, 1940. She was seen again on April 12, 1940, in excellent health.

CASE II

Mrs. E. K., age 44, white female, was admitted to the hospital complaining of abdominal distention, pain, and fecal vomiting. She gave a past history of several operations, the last one being in December 1939, for relief of intestinal obstruction. The obstruction had resulted from adhesions arising from a previous operation. At the time of admission she was not considered a good operative risk, and the Miller-Abbott tube was introduced. This was on February 19, 1940. The next day, the tip was visualized in the ileum and the patient was placed on a liquid diet. On February 22, 1940, a laparotomy was performed with the tube in place, and adhesions in the region of the ileum were released. Immediately after the operation the liquid diet was resumed. Four days later the tube was removed and the patient recovered uneventfully. She was discharged on March 4, 1940, in excellent condition.

CONCLUSIONS

1. It is highly important to maintain the nutrition as well as the fluid and salt balance in a patient with intestinal obstruction.

2. The intravenous route, while effective, is undesirable.

3. It is possible to feed the obstructed patient orally if suction can be maintained in the intestinal tract.

4. The most effective means of obtaining this suction is by the use of the Miller-Abbott tube.

5. The stimulation of peristalsis by the inflated balloon is often sufficient to overcome the so-called paralytic obstruction.

6. The difficulties of introducing the tube offer no obstacle to its use.

ORGANIZATION FOR STUDIES ON EPIDEMIC INFLUENZA [1]

LABORATORY RESEARCH UNIT NO. 1 [2]

.By Commander Albert P. Krueger, Medical Corps, United States Naval Reserve and Unit Personnel [3]

MOBILIZATION AND PERSONNEL

Mobilization of the personnel of Laboratory Research Unit No. 1, United States Naval Reserve, took place January 31, 1941, on which

date the activity was assigned by the Surgeon General to investigate epidemic influenza. Although the Unit has been on active duty status only 8 months it appears desirable at this time to outline the general features of organization, with the thought that these will be of interest to officers of the Naval Medical Corps and more especially to members of similar units which may be mobilized during the present national emergency.

By way of introduction, it is perhaps relevant to review very briefly the background of the activity's inception and growth. In 1934 the Surgeon General authorized the present officer in charge to proceed with the organization of a laboratory research unit. This research group was to supplement the already-existing facilities of the Naval Medical Corps by providing specialized technical personnel to help in the investigation and control of infectious diseases during periods of emergency expansion. Selection of personnel was carried out over several years' time, appointing as chief pharmacist's mates the most promising condidates for advanced academic degrees in such fields as bacteriology, immunology, biochemistry, etc. Because particularly good opportunities for observation were afforded among the enrollees of the Graduate School, University of California, most of our men were chosen from this source. A total of 22 well-trained specialists were indoctrinated into the United States Naval Reserve and participated in a course of lectures and seminars conducted on the Berkeley campus. The study sessions were limited to consideration of medico-military problems and to advancing our knowledge of newer developments in the investigation of various diseases. Through the cooperation and courtesy of the resident Naval R. O. T. C. staff and of interested individuals on the staff of the Twelfth Naval District Headquarters, occasional hours were devoted to strictly naval subjects such as traditions, customs, and courtesies of the Service.

Initially there was no limit set to enlistments for duty with the Laboratory Unit, but in 1940 a regulation appeared restricting the personnel to a total of 2 medical officers, and 12 pharmacist's mates. The original mobilization orders of January 31, 1941, listed 2 medical officers, 7 chief pharmacist's mates, and 2 pharmacist's mates, second class. To keep pace with expansion of the unit's activities, 3 more men were assigned to duty, including 1 pharmacist's mate, first class; 1 hospital apprentice, first class; and 1 pharmacist's mate, third class. Composition of the group was further altered when commissions in class H-V (S) were granted to 5 of the chief pharmacist's mates.

Isaac L. Shechmeister and Thomas P. Sislock, chief pharmacist's mates; Walter L. Axelrod, pharmacist's mate, first class; Eugene R. Chisholm, and George B. Saviers, pharmacist's mates, second class; Charles R. Webb, Jr., pharmacist's mate, third class; and Harold R. Burkhead, hospital apprentice, first class; all of U. S. N. R.

QUARTERS AND EQUIPMENT

Through an agreement with the President and Regents of the University of California, laboratory and office space was made available for use of the activity in the Life Sciences Building on the Berkeley campus. We now have assigned to us the following rooms:

1. Office and laboratory for officer-in-charge.
2. Office for executive officer, statistician, and assistants.
3. Laboratory for serology.
4. Laboratory for general virus work.
5. Room for autoclaves and for normal animal colony.
6. A small room for tissue culture work.
7. A room for the infected animal colony.
8. In addition to the space detailed above the activity has the use of two other rooms for certain special equipment including a magneto-striction oscillator and cryochem dessicator.

The space selected has proved to be adequate for the present functions of the Unit although certain minor problems arose in adapting the working space to our needs. For example, the rooms housing the normal animal colony and the infected animal colony were found to have defective ventilation for warm weather use. The personnel of the Unit overcame this difficulty by building and installing proper ventilators.

It should be noted that when the Unit took over the space assigned to it there was a complete lack of laboratory supplies and equipment inasmuch as the University, of course, did not plan to furnish these items. In order to utilize the time elapsing before supplies arrived from the Naval Medical Supply Depot, the personnel of the Unit undertook the construction of numerous pieces of equipment. Among the items built were:

One hundred and seventy animal cages with feeders.
Five iron cage racks holding 54 animal cages each.
Three iron racks holding 80 jars of infected mice each.
A large dry-ice box.
A portable dry-ice box for field work.
Motor driven ceiling ventilators.
A field kit to contain all items required for conducting vaccinations.
A field kit constructed to contain the materials required in taking throat washings, securing blood specimens, etc.

By the time the first delivery of supplies from the Naval Medical Supply Depot arrived, in April 1941, much of the construction had been completed and it was possible to start active laboratory work. Construction details have been kept on file in the event that this data may be needed for the commissioning of other naval laboratory units.

When the project for this activity was outlined in December of 1940, the course of investigation was dictated by two principal considerations: first, the Navy's needs; and second, the status of current research in this particular field. It is self-evident that the Navy Medical Corps cannot foster research for the sake of research. Investigative results quite properly are expected to be of such nature that they will contribute to fulfillment of the Corps' mission. Hence in selecting the research field it did not suffice merely to state that the general objective was "studies on epidemic influenza." It was essential to confine investigation to specific aspects of the problem likely to have a practical bearing on the control of influenza within the highly specialized environments of naval commands.

The subjects chosen for investigation were viewed in the light of modern research contributions. More significant advances have been made in influenza research within the past eight years than took place in the whole prior bacteriological era. In 1933 Smith, Andrewes and Laidlaw (1) reported their fundamental work proving that influenza is a virus disease and provided methods for its investigation which have completely revolutionized the experimental approach. A great volume of important work conducted in many different laboratories has followed and so far as possible this data has been made use of in setting up the current program.

For purposes of description the experiments may be grouped under two headings, although in actual practice the groups are largely interdependent.

LABORATORY EXPERIMENTS

1. Use of chick embryo technic for experiments with influenza viruses:
(a) Maintenance of virus by chick embryo passage.
(b) Attempted isolation of virus from human cases.
(c) Detection of residual active virus following reaction between various chemicals and influenza virus.
(d) Virus production for preparation of vaccines.
2. Use of mouse passage influenza virus for various experimental tests.

The different types of influenza virus are maintained in the Swiss Carworth strain of mice by instilling 0.05 cc. of virus suspension into the nostrils of lightly anesthetized mice. Within 2 to 7 days, depending upon the strain of virus and the amount instilled, the animals develop pulmonary lesions which are usually fatal. Customarily at autopsy all five lobes of the lungs are massively consolidated. In sublethal infections when the animals are sacrificed one or more lobes will be found to exhibit consolidation.

To prepare virus suspensions for experimental use, infected mice are killed before complete consolidation has developed. The lungs

are ground up and a 1 to 10 percent lung suspension in broth is pre-
pared. Using this source of virus and also virus obtained from egg
embryos, many laboratory experiments have been undertaken. These
have dealt particularly with practical problems; the results will be
reported elsewhere.

FIELD EXPERIMENTS

The purpose of the field program is twofold:

1. To collect epidemiological data and identify virus strains concerned in
outbreaks of influenza within the Navy.
2. To test available means of vaccinating against the disease.

There have been no major outbreaks of influenza since the Unit was
commissioned but preparations have been made to carry out the neces-
sary laboratory work for identification of virus strains should an epi-
demic develop. Epidemic virus strains can be identified in two gen-
eral ways:

(a) Detection of specific antibodies in the blood serum of infected patients.
The antibody titre attains a high level within 2 to 3 weeks after the onset
of the disease. By conducting complement fixation tests and neutralization
tests, the responsible virus type can be ascertained.

(b) Direct isolation of virus from throat washings. Here the procedure is
more complicated than in serological typing inasmuch as human influenza virus
strains cannot be transferred directly to mice but first must be established in
ferrets. Subsequently mice can be infected in the usual fashion. We do not
have facilities for maintaining a ferret colony, and, as a consequence, have
had to effect arrangements for conducting isolation experiments elsewhere
Through the cooperation of Doctor Bertram P. Brown, Director California
State Department of Public Health, and Doctor Monroe D. Eaton, Director
California State Influenza Laboratory, such work will be done in Doctor
Eaton's laboratories.

A suggested procedure for isolation of influenza virus from the
patient involves direct inoculation of the chick embryo with throat
washings (2). The value of this method has not been established,
but should it prove satisfactory it would avoid the necessity for ferret
passage and hence deserves thorough trial.

Recently Goodner (3) has reported successful application of a
delicate flocculation reaction for detection of small amounts of in-
fluenza virus. The basis for the reaction is simply the fact that collo-
dion particles coated with influenzal antibodies and made into a
stable suspension will agglutinate in the presence of specific influenza
virus. We were conducting experiments along these lines when
Goodner's paper appeared, and expect to continue with them. If
the procedure can be adapted to routine use, it should constitute a
great diagnostic advance; one could detect the virus in throat wash-
ings early in the disease, avoiding the delay of 10 days to 3 weeks

that is necessary when the inoculation and serological methods described above are employed.

In the field of immunization the most promising agent, now available, is the complex virus vaccine produced in the Laboratories of the International Health Division of the Rockefeller Foundation (4). The vaccine consists of type A influenza virus grown with canine distemper virus in the chick embryo. The virus is inactivated with formalin and the suspension dried in the lyophile apparatus. Just before using, the dried material is made into a colloidal suspension by adding sterile distilled water. Several field tests have been conducted with this vaccine among the civilian population (5) (6), but results have been conflicting and it is hoped that more clear-cut evidence as to the vaccine's efficacy may be obtained through the current Navy program.

Vaccination with type A influenza virus vaccine was begun at the Naval Air Station, Alameda, Calif., May 19, 1941. Since that time, personnel at the following stations have received the vaccine: Naval Reserve Air Station, Alameda, Calif.; United States Naval Hospital, Mare Island, Calif.; Marine Barracks, Mare Island, Calif.; Naval Training Station, San Diego, Calif.; Marine Corps Base, San Diego, Calif.; and Camp Elliott, San Diego, Calif. Arrangements have been made for equivalent vaccinated and control groups in each area and the vaccinating has been done without disturbing the work routine or causing personal inconvenience to the men.

The actual work is carried out as follows:

Two or three days before vaccine is to be administered, alphabetized rosters are submitted from each company, division, or battalion, and a time schedule is set for each such unit to report to the vaccinating center. From the roster and the health records, statistical cards are prepared and special report forms are inserted into the health records.

On vaccinating day, the field crew of six men in charge of a medical officer, arrives sufficiently ahead of time to set up the equipment carried in our vaccinating field kit. It takes the better part of an hour to prepare the work area and make up the vaccine suspension from the dried powder originally supplied. This last step cannot be taken too far in advance since the suspension loses potency with the lapse of time, and 6 hours is recommended as the maximal period it should be allowed to stand.

As the men of each unit report in alphabetical order, one member of Laboratory Research Unit No. 1 and the medical officer are stationed at a table near the entrance to the vaccination room. The name of the individual entering is checked off on the roster, and he is questioned for any allergy to egg protein, and for frequency of colds and attacks of influenza. This information is entered on the statistical card, the medical officer makes an entry in the health record showing the date of administering influenza vaccine and the man proceeds to the table where two members of the vaccinating crew are stationed. One cc. of type A or type B virus vaccine, or both, is injected subcutaneously and the man leaves the room by a different exit.

Blood specimens are obtained from 15 percent of the vaccinated personnel. Every seventh man is routed to the blood specimen table where 10 cc. of blood is removed aseptically; he then reports to the vaccinating crew and is given his injection of vaccine Particular care is taken that the men being vaccinated do not see the process of taking blood specimens, thus avoiding occasional delays due to fainting.

The serum is separated from the clotted blood samples and is shipped to the laboratory in Berkeley for estimation of complement fixing and neutralizing antibodies. The data thus obtained serve two main purposes:

1. They give information regarding recent contact with influenza virus among the test population.

2. The comparative titres of the original specimen and second specimen, removed two weeks after vaccination, furnish a measure of the capacity of the vaccine to stimulate production of immune bodies.

We find, in practice, that a well-trained crew can handle 125 men per hour without undue haste. The limiting factor in field work is the time that must be spent in effecting liaison with the commands to be vaccinated and the time devoted to preparing the rosters and health records for vaccinated and control groups. Seven men working full time on the field project can complete 1,000 vaccinations and 1,000 control records a week.

It is recognized that the vaccinated and control groups should be represented equally in each command visited to insure equal degree of exposure to infection if an epidemic of influenza develops. While it is entirely feasible to accomplish this initially, the shifting of personnel occasioned by the needs of the Service makes it particularly difficult to maintain the groups in anything like their orignal composition. In certain areas, and especially within Marine commands, this is not such an important item because when changes do occur the personnel is more apt to move by units. Consequently we have conducted our vaccination work so far as possible, among the Marines.

Within the past 5 months the following personnel have been vaccinnated:

Eight thousand eight hundred and fifty-eight officers and men of the Navy and Marine Corps and 484 Civil Service Employees. Equivalent numbers of controls were established in each working area. In order to provide the broadest possible immunizing basis in the test vaccine it was decided to incorporate type B virus as part of the immunizing dose. Preparation of the vaccine was conducted under the direction of Dr. Monroe D. Eaton in the laboratories of the California State Department of Health. The type B virus was grown on the chorio-allantoic membrane and subsequently was inactivated with formalin. The inactivated virus suspension was not dried, but was kept on ice at all times. Three thousand individuals were given a 1 cc. injection of type B virus vaccine in addition to the usual dose of type A virus vaccine. The data on the results of the vaccination with type B virus vaccine will appear as a joint publication from the laboratories of this activity and of Doctor Eaton.

It is anticipated that all cases of influenza occurring either in the vaccinated group or the control group will be reported on the health record forms. The accuracy of such reporting naturally has great statistical significance, and particular efforts have been directed toward establishing adequate diagnostic criteria: For example, the reporting forms list the customary subjective and objective phenomena observed in influenza and there is little likelihood of serious error being made if the disease is present in epidemic form. On the other hand, sporadic cases would constitute a considerable reporting hazard and one would have to be extremely careful in differentiating between true influenza and catarrhal fever. To effect an absolute differentiation by clinical means alone is admittedly difficult. Since most of the signs and symptoms are shared by the two syndromes in greater or lesser degree, it may clarify matters somewhat if the typical pictures are summarized.

Examples of catarrhal fever are found the year round in all dispensaries ashore and afloat. The patient usually experiences chills, a sense of aching in all the joints, and complains of symptoms referable to some sort of upper respiratory infection. Evidence of pharyngitis, sinusitis, tonsillitis, or tracheitis is readily elicited and accounts for the moderate elevation of temperature that is present. Bed rest coupled with treatment of the infected area results in defervescense within 24 to 72 hours; the symptoms clear up rapidly and uneventful convalescence ensues without any notable debilitation.

The typical case of influenza is marked by sudden onset, severe chills, aches and pains in the back and limbs, prostration and fever of from 1 to 7 days duration. The degree of prostration is commonly out of all proportion to the extent of the physical findings and the temperature is usually higher than is the case in catarrhal fever, although there are no striking signs of infection in the respiratory tract. The occurrence of leukopenia is diagnostically helpful, but unfortunately it is not a constant finding. Usually the temperature remains elevated for from 3 to 5 days, and within this period a severe, hacking, dry cough accompanied by marked substernal pain, develops. Long after the temperature has returned to normal, the cough persists and is often the last symptom to disappear. While roentgenograms, taken on the fourth or fifth day, may show increased tissue density at both lung bases with increased bronchial markings, physical examination reveals very little in the lung fields. The list of sequelae following influenza is a long one and requires no discussion here except to say that the characteristic asthenia is very frequently prolonged and far surpasses that observed in catarrhal fever. Although clear-cut clinical differentiation between catarrhal fever and influenza is not always simple, one should suspect

the presence of the latter disease when there is a sudden unexpected increase in the number of patients at sick call who complain of respiratory infections.

The circular letter sent out to medical department personnel requests cooperation in avoiding errors of reporting and contains instructions for obtaining blood specimens for the laboratory diagnosis of influenza in each suspected case. The first blood sample is taken within 5 days of the onset, and the second sample, at least 2 weeks later. Through this procedure, any diagnostically significant rise in titre of antibodies against one of the known strains of influenza virus, can be detected.

Unquestionably there exist other strains of influenza virus besides those included in the two vaccines under test. Should an epidemic due to such a virus develop, the conditions for testing the vaccines used will not prevail. This is a hazard that must necessarily exist and which we cannot obviate at the present time. Later, the inclusion of other virus types and probably the concentration of virus in the vaccines employed will improve the chances of success.

One of the first questions arising when an influenza vaccination program is initiated in any naval activity is "Will there be any disabling reaction?" Every immunizing agent, no matter how well purified, always has the potentiality for producing a reaction in an allergic individual. The influenza virus vaccines contain proteins but the amount is fortunately so small that there is usually no untoward reaction subsequent to hypodermic injection. Generally the patient notices a little stinging, at the site of inoculation, which lasts for a few minutes, and is largely due to the formalin employed to inactivate the virus. Altogether we have had five allergic reactions definitely attributable to administration of the vaccine, or one for every 1,870 individuals vaccinated. Four of these were minor and consisted of varying degrees of transient urticaria, palpebral edema, nasal congestion and slight malaise. The fifth case was serious and if it had not been for prompt medical care it is likely that the patient would have died. A brief outline of this case follows:

Fifteen minutes after vaccination with 1 cc. of type A virus vaccine, C. H. L., U. S. M. C., age 25, collapsed and developed profound shock. He was seen at once and was distinctly cyanotic, with blood pressure 70/0, pulse not obtainable. Customary antishock treatment and administration of adrenalin brought about some improvement. The patient stated that he had difficulty breathing, and that he felt a tingling sensation throughout the extremities. One hour after onset he vomited, complained of epigastric pain, and upon examination, generalized rigidity over the abdomen was elicited. Continued administration of heat, adrenalin, and atropine produced improvement but 5 hours after onset the patient's condition was sufficiently serious to warrant transfer from Camp Elliott to the United States Naval Hospital, San Diego. Here shock treatment was continued, and, in addition, oxygen was administered. Within 18 hours the patient was out of danger and made an uneventful recovery.

While every individual appearing in the vaccination line is questioned regarding sensitivity to eggs, it is rare that we find anyone who gives such a history among the group of healthy young adults we are dealing with. Further, a negative answer to the question does not preclude a reaction to the vaccine. This is shown in the nearly fatal case of anaphylactic shock reported above. The patient did not report allergic sensitivity to eggs, yet he had a violent shock reaction following administration of the vaccine. Even if it were feasible to conduct skin tests with chick embryo extract it is unlikely that the procedure would avoid these unfortunate occurrences. The best practical solution, under the circumstances, appears to be constant medical supervision of the vaccination line and immediate treatment of such shock reactions as may occur. An incidence of one shock reaction in 9,342 vaccinations, or 0.010 percent of the total vaccinated group is low indeed.

DISCUSSION

The field project of Naval Laboratory Research Unit No. 1, described above, has a very limited objective; namely, the clinical evaluation of two influenzal vaccines, one containing formalin-inactivated type A virus, and the other, type B virus similarly inactivated. Despite this somewhat deceptive appearance of simplicity, success of the venture in obtaining valid positive or negative evidence is not assured because any answer depends upon the occurrence of type A or type B influenza virus in the population under study. If epidemic influenza does not appear or if the disease should be of a different type no significant information will be obtained. Should infection with influenza virus A or influenza virus B become prevalent during this fall, winter, or spring, conditions among the population at risk are favorable for evaluation of the two vaccines used. Vaccinated and control groups numbering about 9,000 each will be exposed under practically identical environmental conditions. The factors of age and sex are controlled and there are no occupational variables of consequence.

However, the existence of certain adverse factors must not be disregarded. Chief among these is the movement of individuals in compliance with requirements of the Service. At some stations such as the Naval Training Station, San Diego, the widespread dispersal of personnel to various ships and stations is a routine matter. Consequently the program among these men was restricted and emphasis was placed on vaccination of Marines instead. Among the Marine personnel of Camp Elliott and the Marine Base, San Diego, composition of the individual units is fairly stable and while a whole division may be shifted the vaccinated and control groups comprising the division will be equally exposed to the new environment.

There remain certain reporting hazards. If influenza appears in epidemic form, careful clinical diagnosis should furnish a suitable basis for our statistics. Direct isolation of the virus, its detection by means of the colloidal agglutination reaction, and typing of antibodies will be carried out whenever possible. Under these circumstances the error due to misdiagnosis should remain small. In contrast, sporadic cases of influenza will occasion a good deal of diagnostic difficulty. Clinical diagnosis is by no means simple and particular dependence will have to be accorded to laboratory procedures. Nevertheless the total number of sporadic cases should be small enough to keep the percentage error at a low level.

The general trend of laboratory work with viruses is sufficiently encouraging to warrant prediction that the search for an immunizing agent against influenza will be a successful one. The present vaccines may not prove to be the final solution, but considering the great strides which have been made in accumulating information about the nature of influenzal infection, it seems not in the least over-optimistic to anticipate the development of a really adequate immunizing agent in the near future.

SUMMARY

The present paper is more of a progress report than a completed record of experimental results. It covers the work program of Laboratory Research Unit No. 1, United States Naval Reserve, for the period February 1, 1941, to September 30, 1941, and describes the following phases of the Unit's activities:

(a) Mobilization and personnel.
(b) Quarters and equipment.
(c) Nature of the laboratory experimental program.
(d) The conduct of field tests of two influenzal virus vaccines among naval and marine personnel.

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A TABULATION OF THE PATHOLOGY IN THE UNITED STATES NAVAL HOSPITAL, SAN DIEGO, FOR THE YEAR ENDING JUNE 1, 1941

By Commander G. B. Dowling, Medical Corps, United States Navy, and Lieutenant, junior grade, J. A. Brantley, Medical Corps, United States Navy

As there have been quite a number of interesting cases here during the past year, many of them brought to light by biopsy examination, and others by postmortem studies, it was decided to review and tabulate the results of the studies made on tissue referred to the pathology department. This report covers the biopsy and autopsy reports during the year from June 1, 1940, to June 1, 1941.

The following is a tabulation of the pathological diagnosis made from tissues referred to the pathology department. This table does not cover material examined at postmortem.

Appendicitis, acute	178
Appendicitis, acute, gangrenous	6
Appendicitis, acute, suppurative	130
Appendicitis, chronic	293
Appendicitis, normal	18
Appendicitis, subacute	64
Appendicitis, fibrous, obliterative	28
Adenoma, benign	1
Abscess wall	3
Bone marrow, normal	1
Bursitis, chronic	2
Carcinoid, appendix	1
Carcinoma:	
Basal cell	12
Bladder	3
Breast	1
Cervix	2
Embryonal, left testicle	1
Liver	1
Lymph node, metastatic	2
Hip, metastatic	1
Mixed (squamous and basal cell)	2
Omentum, metastatic	2
Pancreas, head of	2
Prostate	3
Sigmoid	2
Squamous cell	12
Stomach	2
Cervicitis, chronic	21
Cervix, normal	1
Cholecystitis, chronic	17
Chondroma, rib	1
Condyloma, Syphilitic	1

Cyst:

Branchial	2
Dermoid	2
Pilonidal	8
Sebaceous	12
Simple	5
Thyroglossal	1
Diverticulitis, acute, Meckel's	1
Endothelioma	1
Epididymitis, chronic	1
Epididymitis, tuberculous	1
Fibroadenoma breast	3
Fibroma	11
Fistulous tract	4
Ganglion, tendon sheath	2
Gastritis, chronic	3
Granulation tissue, nonspecific	16
Granulation tissue, tuberculous	2
Hemangioma	2
Hemangioendothelioma	2
Hematocele	1
Hemorrhoidal tissue	2
Hodgkin's disease	2
Hydronephrosis	4
Hydrocele	2
Hyperkeratosis	9
Hypernephroma	2
Ileitis, regional	2
Inflammatory tissue, miscellaneous, nonspecific	48
Keloid	5
Lens, ocular	2
Lipoma	12
Mastitis, chronic	7
Melanoma, eye	2
Melanoma, skin	1
Myeloma, plasma cell, of bone	1
Neurofibroma	6
Nevus	21
Normal tissue, miscellaneous	31
Orchitis, chronic	1
Osteochondritis dissecans	1
Osteoma	2
Papilloma	21
Panophthalmitis, chronic	1
Pharyngeal hyperplasia, lymphoid	5
Pleural fluid, negative for malignant cells	2
Placental tissue	1

Polyp:

Aural	1
Cervical	3

Polyp—Continued.

Nasal ___ 4

Oral ___ 1

Rectal ___ 2

Prostatic hyperplasia ___ 10

Psoriasis ___ 3

Pterygium ___ 1

Sarcoid, Boeck's ___ 1

Sarcoma:

Neurogenic ___ 2

Nares ___ 1

Ewing's ___ 1

Lympho-sarcoma, reticular cell ___ 1

Sclerosis, Monchenberg's ___ 2

Sputum, negative for malignant cells ___ 2

Synovitis ___ 2

Teratoma, chorionepithelioma, testicle ___ 1

Testicle, atrophic ___ 3

Thromboangitis obliterans (amputated leg) ___ 1

Tuberculosis cervical, of lymph gland ___ 2

Tumor, giant cell of tendon sheath ___ 3

Ulcer, duodenum ___ 7

Ulcer, rectum ___ 1

Ulcer, stomach ___ 10

Verruca vulgaris ___ 6

In addition to the above, there are reports on tissue studies made on 81 guinea pigs after inoculation with material suspected of being tuberculous. Ten of these animals were positive for tuberculosis while 21 were negative.

The following table presents a summary of the autopsy studies during the past year. The diagnosis given is the one considered to be the primary cause of death from the pathologist's point of view.

Abscess, brain, multiple ___ 1

Abscess, multiple ___ 1

Abscess, lung ___ 2

Abscess, retroperitoneal ___ 1

Aneurysm, Congenital, anterior cerebral artery, ruptured ___ 1

Aneurysm, dissecting, aorta ___ 1

Aneurysm, multiple, aorta (syphilitic) ___ 1

Arteriosclerosis, generalized ___ 2

Arteriosclerotic heart disease ___ 5

Carcinoma:

Colon ___ 2

Kidney (Grawitz tumor) ___ 1

Liver ___ 1

Lung ___ 2

Prostate ___ 1

Rectum ___ 2

Stomach ___ 2

Carcinoma—Continued.

Cardiac dilation (acute) _____ 1

Cirrhosis, Liver _____ 4

Coccidioidal granuloma, lungs and brain _____ 1

Endothelioma:

Pleura with metastasis _____ 1

Right inguinal region with metastasis _____ 1

Endocarditis:

Bacterial, acute _____ 2

Bacterial, subacute _____ 1

Enteritis, regional _____ 1

Emphysema, pulmonary _____ 2

Ewing's tumor, right tibia with extensive metastasis _____ 1

Glioma (astrocytoma protoplasmaticum), brain, left frontal lobe __ 1

Hemorrhage, cerebral _____ 1

Hodgkin's disease _____ 2

Injury, intracranial _____ 7

Leukemia, monocytic _____ 1

Meningitis, cerebral, basal (tubercular) _____ 1

Myocarditis, chronic _____ 8

Obstruction, intestinal, postoperative _____ 1

Pericarditis, acute tuberculous _____ 1

Pericarditis, adhesive _____ 1

Peritonitis, generalized _____ 1

Pneumonia, broncho _____ 3

Pneumonia, lobar _____ 6

Pyonephrosis _____ 1

Rheumatic heart disease _____ 1

Rupture, left ventricle _____ 2

Septicemia, generalized _____ 1

Status lymphaticus _____ 1

Teratoma, malignant, right testicle, with metastasis _____ 1

Thrombosis, cerebral _____ 2

Thrombosis, coronary artery _____ 14

Tuberculosis, pulmonary _____ 7

Tumor, mixed, salivary gland _____ 1

Ulcer, duodenum, perforated _____ 1

Uremia _____ 1

Wound, gunshot, spine and abdomen _____ 1

In reviewing the autopsies, certain ones offered unusual findings. Grouping the unusual under the primary cause of death, the following are presented:

A. Cardiac Death

1. Ruptured ventricle secondary to myocardial infarctions (2).
2. Dissecting aneurysm ruptured at the level of the diaphragm (1).
3. Thrombosis, coronary—involving the auriculoventricular (His) bundle.
    a. One of these occurred in a 26-year-old marine officer with sudden death (2).
4. Abscess, subendocardial—left ventricle (staphylococcal) with septicemia and multiple septic infarctions.
5. Pericarditis, acute tuberculous.

B. Intracranial

1. Aneurysm, Congenital, anterior cerebral artery with rupture into left ventricle.
2. Thrombo-angiitis obliterans, terminal with involvement of left internal carotid at base of brain and encephalomalacia.
3. Coccidioidal granuloma, brain and lungs.

C. Gastro-intestinal Tract

1. Carinoma of stomach:
    a. One case showed five primary carcinomatous lesions in the stomach.
    b. One case showed metastasis by continuity to liver with almost complete destruction of left lobe.
2. Carinoma of intestines:
    a. One case with multiple polyposis involving the entire large bowel with five distinct areas showing carcinomatous degeneration.
3. Regional ileitis with segmental involvement of large intestine.

D. Respiratory Tract

1. Coccidioidal granuloma—lungs and brain.
2. Endothelioma, pleura with metastasis.

E. Leukemia

1. Monocytic with leukemic infiltration submucosa entire stomach.

These autopsies were presented because of the unusual interest manifested by the entire hospital staff.

CREEPING ERUPTION

INFESTATION WITH ANKYLOSTOMA BRAZILIENSE LARVAE

By Lieutenant Commander J. A. Millspaugh, Medical Corps, United States Navy, and Lieutenant L. M. Sompayrac, Medical Corps, United States Naval Reserve

Attention is invited to a dermatological infestation that assumes increasing importance because of extensive naval expansion and consequent growing personnel in a geographical area where the incidence of creeping eruption is high and where the disease is endemic. The areas particularly involved are the Southeastern Atlantic Seaboard and the Mexican Gulf Coast, as well as nearby insular dominions, Central and South America. Many medical personnel are unfamiliar with this disease only because they secured training where the infestment is nonexistent or rare.

Creeping eruption is a skin disease characterized by the presence of a serpiginous, tortuous, linear, erythematous, papular or vesicular, pruritic eruption which gradually advances at one end while it slowly fades at the other. The initial lesion is a minute erythematous macule, vesicle or urticarial papule. A stinging pain similar to a

mosquito bite may be noted during larva penetration. Within from 1 to 3 days, itching indurated papules appear; followed, during the next several days, by zig-zagging, raised, red migratory lines about 1 to 2 mm. wide. Warmth accelerates migration, which is greater at night, but progress is often interrupted by phases of rest. Travel is exceedingly irregular; and as though the larva were tethered, it crosses, doubles back, and branches in erratic, aimless pattern, rarely exceeding a few inches from the point of individual larval penetration. Advance may vary from 1 to 30 cm. in 24 hours. Intractable itching is especially refractory at night. Excoriations afford ready portals for secondary infections.

Creeping eruption is caused by the presence of the parasitic larvae of the genera *Nematode Ankylostoma braziliense* which burrow within the skin. The common name is dog or cat hookworm. Less specific synonyms are larva migrans and wet sandworm disease; the latter term is used largely by the British. The term "larva migrans" has been indiscriminately applied to various larval infestations of the skin. The various organisms that cause larva migrans in a certain case can be decided positively by actual demonstration of the larvae. This is usually impractical. Clinically, the eruption produced by the *Ankylostoma braziliense* is more inflammatory than other similar infestations. In any event, the treatment proposed is effective for all larvae of migrating habitus. *Gastrophilus* (bot fly), *Gnathnostoma* (pig and cat nematode), and *Hypoderma* (warble fly grub) may be differentiated from *Ankylostoma braziliense*. Organisms of the former groups are readily distinguished by their larger size; *Gnathnostoma* larvae are 1 cm. in length; *Gastrophilus* 1 to 2 mm.; *Ankylostoma braziliense* only 0.5 mm. x 20 microns. Chigger (sand flea) bites, various fungi, and scabies may be differentiated with the aid of a hand lens or skin scraping. Often mistaken for the chigger bite at first, there is little difficulty after the burrow has appeared. There are no systemic manifestations except the fatigue that might follow sleepless nights. Eosinophilia is usually present. After extensive search for the *Ankylostoma braziliense* in the stool of grossly infested individuals, one of the authors (L. M. S.) failed to demonstrate the parasite. This has been corroborated by others.

The source of infestation is soil, usually moist sandy soil, contaminated with infective larvae from ova in stools deposited by the dog or cat. Most of the cases seen in dispensaries and hospitals in Jacksonville, Fla., are contracted at the beaches. Here dogs are not restricted, and the white soft sands, that are not washed by the tides, are heavily contaminated. These sands are particularly alluring to the bathers who enjoy covering themselves with it. The incidence increases in hot and rainy seasons. Following a storm, when beaches

FIGURE 1.—SHOWING EXTENSIVE CREEPING ERUPTION, SECONDARY INFECTION
AND DEPIGMENTATION.   INFESTATION CONTRACTED WORKING IN DAMP SAND.

are flooded to the sea wall with salt water, fewer cases are seen for awhile thereafter. There are also fewer cases seen during the winter; frost kills the larva. A number of cases are also encountered in workmen such as electricians, plumbers, and carpenters who come in contact with damp soil under houses. Wherever an infested domestic pet roams in suitable climate and soil, the infestation lurks.

The mode of transmission is larval skin penetration only. The disease is not communicable. The incubation period varies from hours to days. The dog and cat are potential carriers as long as they remain infested and continue to pollute soil. Susceptibility to infestation is universal. The more tender the skin, the greater the likelihood of infestment.

Creeping eruption is widely endemic in areas having favorable soil, temperature, and moisture for development. Prevalence of creeping eruption is rife in the areas above mentioned. Methods of control consist of prevention of soil pollution. Deny beach privileges to the domestic pet. Educate the bathers to use only that part of the beach which is washed by the tide. Treatment of the intermediate host with tetrachlorethylene is standard veterinary practice. Personal prophylaxis consists of wearing shoes and avoiding skin-soil contact in areas likely contaminated.

In the treatment of creeping eruption, two physical agents are specific, if properly applied: refrigeration and cautery. The former is accomplished by means of ethyl chloride spray or solid carbon dioxide. The parasite is localized 0.5 to 3 cm. in advance of the acutely inflamed end of the burrow. The spray is directed to this site, and application is continued beyond the blanching stage and until the skin treated feels like old leather between the palpating fingers. The tendency is to desist before sufficient refrigeration has taken place. A medical burn may be produced upon tender skin if the treatment is too prolonged, but this is not serious. Precaution should be taken concerning the inflammability of ethyl chloride. A container with a screw cap outlet permits better control and less waste. Solid carbon dioxide usually produces a more serious reaction but is, nevertheless, effective in topical application. Repetition of ethyl chloride treatment may be necessary, especially if the lesion occurs in the thick skin of the sole of the foot.

An alternate treatment is the actual use of the galvanic cautery. To locate the larva cleanse the skin with 70-percent alcohol and apply cedarwood oil to the suspected larval rest. Examine with a good hand lens or with a two-thirds inch objective lens of a dissecting microscope. The area surrounding the larva appears as a yellowish-white spherical mass of plasma or an accumulation of minute vesicles. Inject with a small sharp needle a few minims of 0.5 to 1 percent procaine to de-

sensitize an area 1 cm. in diameter with the larva in the center. Apply cautery until a small burn is apparent. One application is sufficient. Except for the needle prick, this method is painless. Subsequent treatment may be that employed in any second-degree burn. We usually recommend boric acid solution soaks and boric acid ointment. Patients presenting gross lesions, particularly of the extremities, often require hospitalization.

CONCLUSION

1. Human skin infestation with the larvae of *Ankylostoma brazili-ense* (dog hookworm) causes a disease properly called creeping eruption.

2. Creeping eruption incapacitates an increasing number of personnel in our southern area of naval expansion.

3. The description, prophylaxis, and treatment of this highly aggravating infestation are reviewed.

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AUDITORY ACUITY IN SUBMARINE PERSONNEL

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PART II [1]

HEARING LOSS DUE TO EXPOSURE TO RADIO UNDER SERVICE CONDITIONS

This is the second in a series of articles on auditory acuity in submarine personnel involving both acute and permanent loss of hearing due to various types of auditory trauma. In the first article (1) Diesel engine noise was conclusively demonstrated to be one of the causes of acute and permanent loss of hearing. In this article, we present a report on radiomen, both submarine and general service, and compare them to "normal groups" of like age. The technical operations and examinations for this section were conducted as detailed in the original article.

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[1] Part 1. UNITED STATES NAVAL MEDICAL BULLETIN. 42: 27–42, Jan. 1942.

Opportunity for examining men suffering from acute loss due to exposure to sudden violent radio trauma did not present itself. However, although no cases were actually examined at the time of the acute exposure, many of the histories contained statements to the effect that while listening to a distant station, a nearby station suddenly came in with such power as to render the listener temporarily deaf, and in some cases, caused such shock that it was several minutes before recovery was sufficient to permit even routine work. Although but inconclusively demonstrated by our experiments, it is believed that this traumatism, especially when oft repeated, definitely leads to permanent loss of hearing.

TABLE No. 1—*Radiomen "pure"—permanent damage. Percent hearing loss*

Average length of exposure	Frequency (cycles)							
	64	128	256	512	1024	2048	4096	8192
30.3 months—ages 15–24	4.2	1.9	5.25	6.0	1.25	5.9	10.5	15.0
85.3 months—ages 25–34	8.33	2.5	6.9	10.2	4.0	9.8	23.27	23.5
148.2 months—ages 35–44	11.0	5.5	9.1	9.25	5.8	14.6	28.1	31.8

The permanent loss of hearing in radiomen is shown in tables 1 and 2. Table 1 demonstrates that hearing loss is significantly related to the duration of the exposure to radio work with ear phones. Thus, men of ages 15–24, averaging 30.3 months radio exposure, show an average hearing loss of 6.25 percent; men of ages 25–34, averaging 85.3 months, show an average loss of 11.6 percent; while men of ages 35–44, averaging 148.2 months, show an average hearing loss of 14.4 percent. This loss is apparent in the lower as well as the higher frequencies throughout the entire range tested. The loss is of significance when it is considered that these are "pure" cases, i. e., they give no history of disease, infection, injury or other trauma to account for the loss of hearing other than the exposure to the acoustic trauma of radio signals under service conditions, i. e., with ear phones. By comparing these groups with the normals given in table 2, it will be apparent that the loss is much greater than can be accounted for by age alone.

In table 2, we present "pure" radiomen divided into three groups as compared with three normal groups of the same age. Ages 15 to 24 and 25 to 34, inclusive, are compared with our normals for the same age. These normals, as explained in the first article, are those who gave no history of injury, infection, disease or any traumatism considered to be predisposing to loss of hearing. Ages 35 to 44 are compared to the Public Health normals referred to in the original article which, probably because they were not on selected subjects, tend to be higher than ours. Notwithstanding this, the radiomen show a

significantly increased loss for every frequency. In the last two horizontal columns a compilation of all of the "pure" radiomen is given for comparison with all of the "miscellaneous" radiomen. As would be expected the additional trauma encountered by the latter group shows itself in an increased loss of hearing over the "pure" group in all frequencies.

TABLE No. 2.—*Radiomen—Permanent damage*

[Hearing loss in terms of decibels or sensation units]

	Frequency cycles							
	64	128	256	512	1024	2048	4096	8192
Our normal—ages 15–24	2.2	0.52	5.1	7.1	2.2	6.8	14.1	12.6
Radiomen (pure)—ages 15–24	2.5	1.7	5.9	7.5	1.7	7.4	12.4	14.4
Our normal—ages 25–34	1.5	1.2	4.7	7.2	−.4	5.6	14.0	16.3
Radiomen (pure)—ages 25–34	5.0	2.1	7.7	13.1	5.3	12.3	27.0	22.1
P. H. normal—ages 35–44	3.2	3.8	8.6	8.0	3.0	4.2	26.2	21.7
Radiomen (pure)—ages 35–44	6.4	4.9	10.1	11.7	5.5	18.7	32.7	29.7
Radiomen (pure)—all ages	5.5	1.1	9.0	11.3	4.6	16.2	28.6	27.3
Radiomen (miscellaneous)—all ages	4.6	3.9	11.3	13.4	6.1	19.2	33.1	29.9

In figures 1 to 4, inclusive, we present four individual audiograms of "pure" radiomen. It will be noted that but one had submarine duty, thus submarine service in itself is eliminated as the cause of this loss. It has been shown that age is not the controlling factor and since all other factors have been ruled out in these "pure" cases, the damage must be considered as unquestionably resulting from radio acoustical traumatism. Of particular interest is the loss of hearing in the mid-low frequencies as compared with the loss in the same frequencies resulting from exposure to diesel engine noise.

Significantly, the majority of earphones issued to the naval service are particularly resonant at these mid-low frequencies. This may be demonstrated by maintaining a constant input power level into the earphones and varying the frequency at this constant level. Pronounced resonance will be noted at about 400 to 500 cycles. This may account for the mid-low frequency hearing loss. Extreme loss in the high frequencies is also noted and is, particularly in the frequency 8192, greater than in exposure to diesel engine noise.

Two other specific cases are reported (figs. 5 and 6) from the "miscellaneous" radiomen group.

DISCUSSION

Data have been presented showing a permanent loss of hearing for radiomen in the naval service. As is to be expected, this loss has a high correlation to the length of service as radiomen. However, extreme loss of hearing is usually caused by some definite or oft-repeated acoustic trauma such as the "blasting" effect previously mentioned.
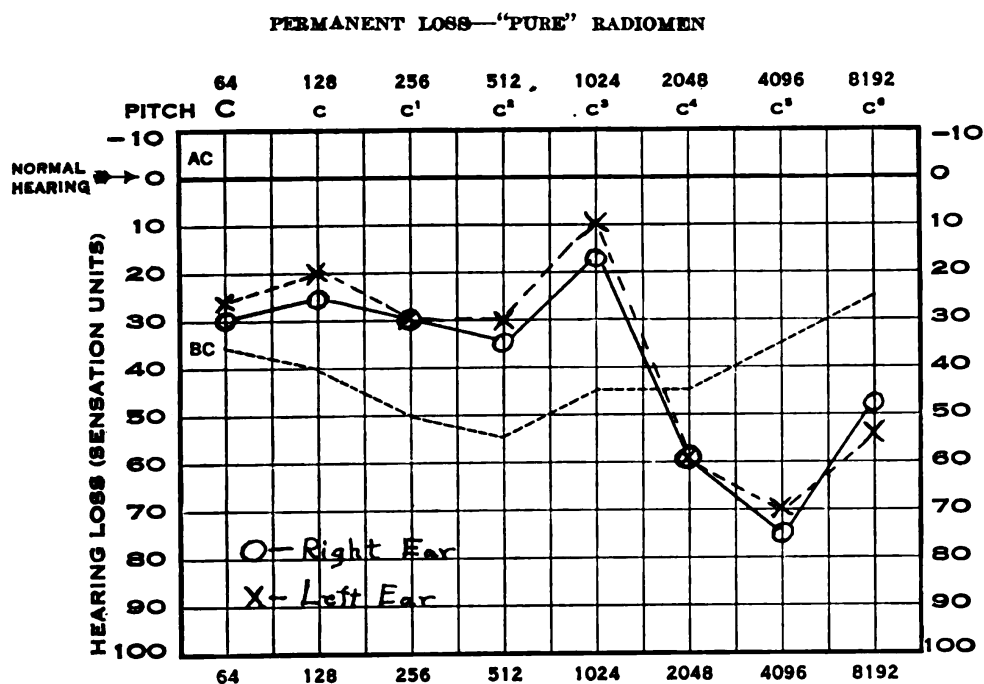
PERMANENT LOSS—"PURE" RADIOMEN

FIGURE 1.—W. M.—R. M. 1/c. Age 35 yrs. 16 yrs. naval service. 188 months wearing earphones. History otherwise negative. Watch tick right 8/40, left 28/40. Whispered voice right 4/15, left 4/15. Ear drums thickened. Physical otherwise negative.
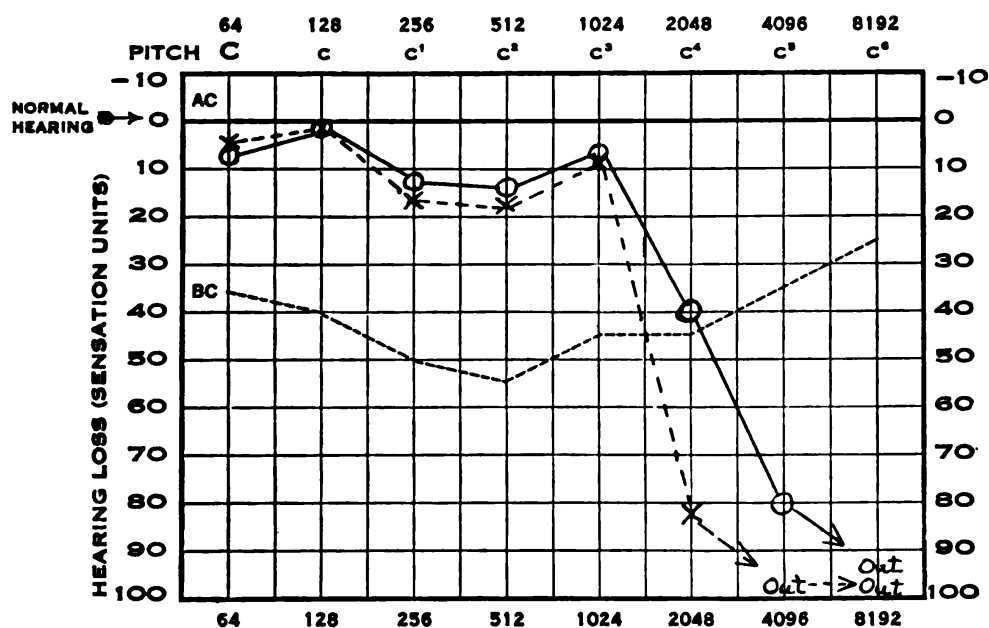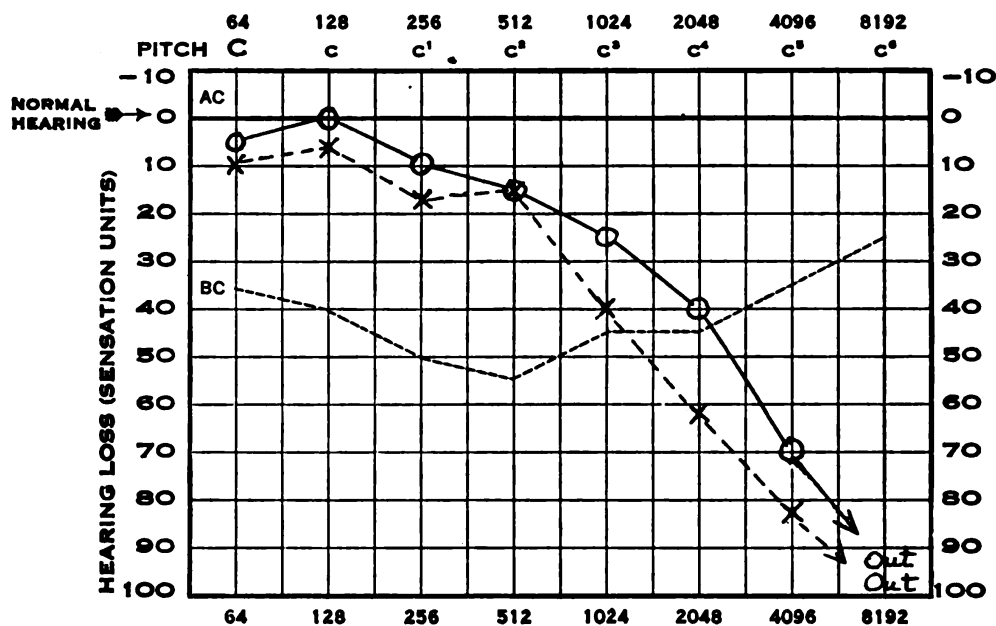

FIGURE 2.—W. E. R.—C. R. M. Age 45 yrs. 17 yrs. naval service. 19 months on submarines. 168 months as radio watch stander. History otherwise negative. Both drums slightly thickened. Watch tick contact only for both ears. Whispered voice right 6/15, left 8/15. Coin click 2/20 both ears. Weber lateralizes to the right. Physical otherwise negative.

FIGURE 3.—J. W. P.—C. R. M.   Age 40 yrs.   19 yrs. naval service.   No submarine service.   216 months as radio watch stander.   History otherwise negative. Left ear drum thickened.   Watch tick right 4/40, left 2/40.   Whispered voice right 7/15, left 1/15.   Coin click right 18/20, left 2/20.   Physical otherwise negative.
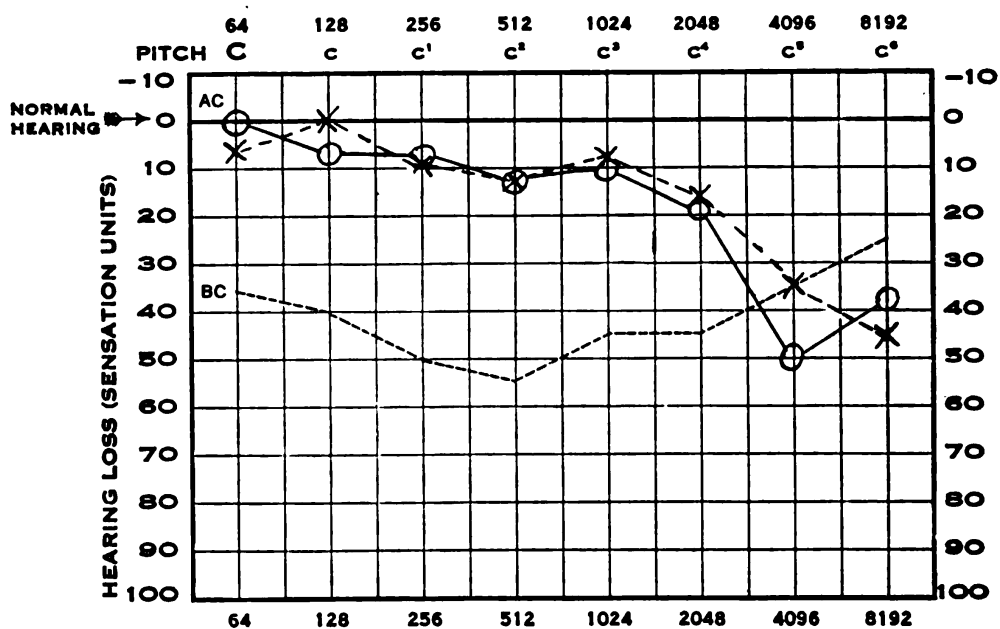
FIGURE 4.—J. L. E.—R. M. 1/c. 8 yrs. naval service.   No submarine service.   60 months radio watch standing.   History otherwise negative.   Watch tick right 4/40, left 12/40.   Physical examination otherwise negative.

PERMANENT LOSS—"MISCELLANEOUS" RADIOMEN
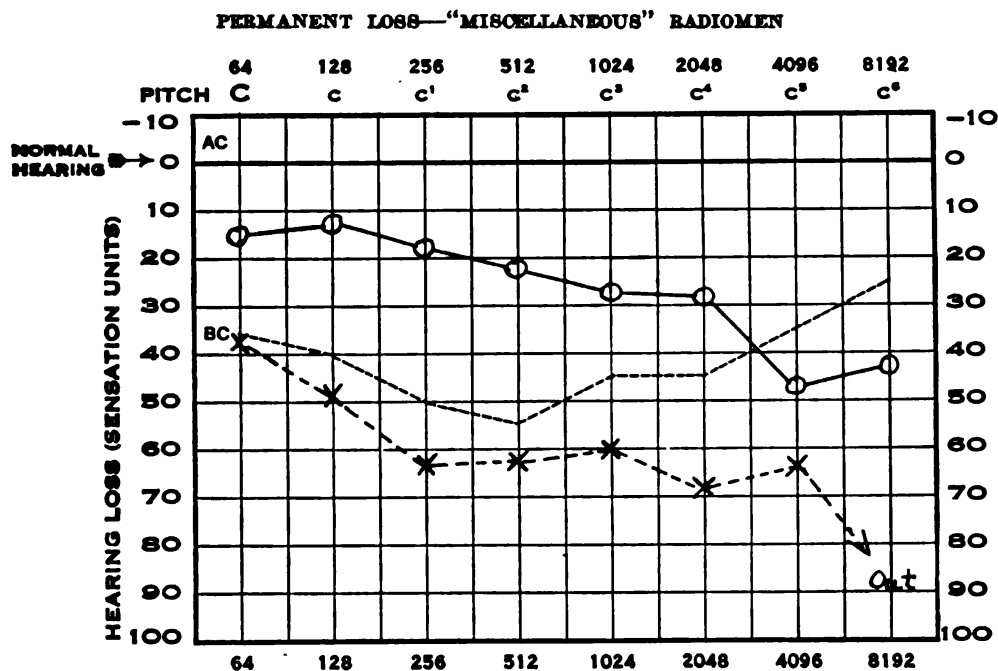
FIGURE 5.—H. A. M.—C. R. M. 20 yrs. naval service. 144 months submarine service. 168 months radio watch standing. Air pressure accident caused damage to left ear. Head colds cause partial temporary deafness. Examination right drum thickened and retracted, left drum scarred, thickened, retracted and numerous white plaques. Watch tick right contact, left 0/40. Whispered voice right 10/15, left 0/15. Spoken voice right 15/15, left 2/15. Coin click right 12/20, left 2/20. Weber lateralize to the right. Rinne positive on right, negative on left. Physical examination otherwise negative.
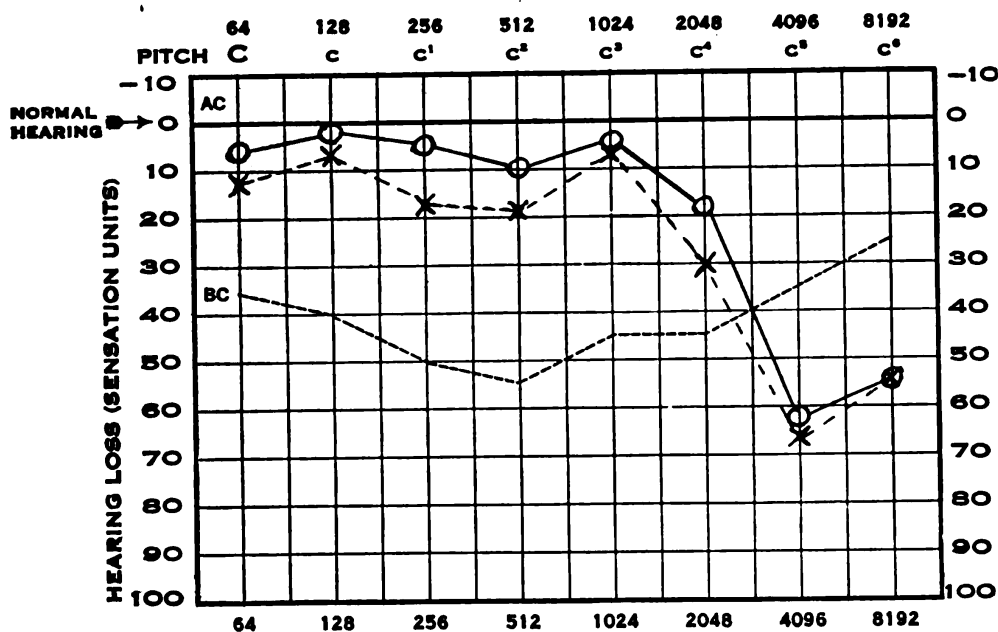
FIGURE 6.—J. S. L.—C. R. M. 17 years naval service. No submarine service. 84 months radio watch standing. Abscess left ear age 21 years, lanced, drained 3 weeks. History otherwise negative. Examinaion, right ear drum normal, left ear drum scar and thickened area 3 o'clock. Watch tick right 10/40, left 1/40. Whispered voice right 13/15, left 12/15. Coin click right 20/20, left 18/20.

This trauma is not only significant from the viewpoint of loss of hearing but such acoustical trauma has been shown to have a marked effect in loss of efficiency and in increase in the number of errors made. Laird (2) demonstrated an increase in the speed of typing when the noise level was lowered as well as a reduction in the number of errors. Also of interest was the demonstration of the increase in metabolic rate associated with an elevation of the sound level, thus accounting for the early fatigue experienced when working under noisy conditions.

An investigation of the literature disclosed no reports on radiomen but Bunch (3) presented a review of the literature on "Deafness From the Use of the Telephone" and discussed six cases which he investigated and which tend to show that the mere use of the telephone in itself is not enough to cause permanent loss of hearing but that some definite acoustic shock, such as might result from lightning striking the line, etc., would definitely cause a marked permanent loss of hearing.

In this connection, our experiments demonstrate the fact that the exposure to the acoustical trauma in the wearing of earphones in radio work is sufficient to cause permanent loss of hearing. As in telephone work, extreme loss most often results from some oft-repeated trauma of a more or less violent nature.

It cannot be too strongly emphasized that all our radio equipment should be so constructed as to eliminate the possibility of such acoustic shock and trauma to our operators. Telephone companies and others in this field have long recognized this and have devised and installed various so-called guards. Of these, the "click" receiver is probably best adapted to navy use. The signal is not distorted, in fact intelligibility is improved. In this type, the shielding is done in the earphone itself. Some receiving sets are so constructed as to eliminate all peaks of noise and to cut in again automatically when the sound level becomes sufficiently reduced. Any feature tending to lower or eliminate the acoustical trauma is worth consideration.

The practice of many radio operators of wearing the ear phones behind the ears and increasing the volume is definitely wrong and should be discouraged as it ultimately leads to loss of hearing. The discomfort due to pressure on the ear is avoided by this practice but the acoustical trauma to the middle ear continues by way of bone conduction and because of the increased volume required for audibility may produce even greater injury.

It is readily seen from the data presented that it is not necessary that a man have a normal audiogram in order that he be a proficient radioman. Inasmuch as it is the practice on many ships for the radioman to be the "sound" operator as well, it was considered to be

of interest to run audiograms on a group of men selected by their commanding officers as being excellent "sound" operators. This group was found to have audiograms which were below normal in every case and thus it seemed obvious that a normal audiogram is not a requirement for excellence as a "sound" operator.

The Manual of the Medical Department, paragraph 1535 (d) (3) prescribes that, "All officers and enlisted men of such ratings as may be assigned to listening duties shall be tested by the audiometer. The only permissible variation from the normal will be in the wave lengths of 128c and 4096c double frequencies."

Inasmuch as a majority of operators of demonstrated ability did not conform to the above requirements, we determined to find, if possible, some other method of selection which would be truly indicative of ability.

Ability in pitch discrimination being of primary importance for "sound" operators, a method of examining candidates for the sound school was set up and work is now in progress to determine the correlation between ability to discriminate pitch and demonstrated ability as sound operators. We determine pitch discrimination by an audio-oscillator at three frequencies—256, 1024, and 2048, which permits determinations to within one cycle above or below the reference notes mentioned. Controlled background noise levels are used in conjunction with these examinations to simulate actual conditions aboard ship.

SUMMARY

Data have been presented showing permanent loss of hearing due to radio acoustical traumatism.

It has been suggested that acute hearing loss probably follows acoustical shock and if repeated may result in permanent loss.

The desirability of some guard against this traumatism has been suggested and specific methods outlined for its prevention.

A supplementary examination for the selection of "sound" operators is offered in pitch discrimination. A study of this method is now in progress.

Further studies concerning naval hazards to hearing are in progress and will be presented as the work is completed.

To be Continued

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CLINICAL NOTES

COMPRESSION FRACTURES OF THE ANKLE AND FOOT FOLLOWING A TORPEDO EXPLOSION

CASE REPORT

By Lieutenant, junior grade, R. W. Rommel, Medical Corps, United States Naval Reserve

This case has been presented because of the probability of its being the first one in which blood plasma had to be used in an emergency resulting from an actual engagement.

S. K., 26-year-old white male, weight about 200 pounds, was standing on the starboard wing of the ship's bridge at the time of the explosion. The terrific force of the explosion occurred directly beneath him, and he was thrown upward and forward against the pilot house. The patient stated, "I turned a summersault without being able to get my feet off the deck." Later the left foot was found to be completely paralyzed and there was partial paralysis of the right.

Immediately after the accident the patient was conscious, able to talk, complained of some pain in the feet and legs, and was not believed to be seriously injured. Sometime later, the patient's heavy overshoes were removed and were found to be saturated with blood and contained small fragments of bone. Bleeding was coming from wounds on the dorsum of each heel. Pressure pads and splints were applied, and the patient was placed in his bunk.

The sick bay of the ship, containing about three-quarters of the medical supplies, was inaccessible, leaving only the contents of the aft dressing station to work with.

When first seen by me, the patient was apparently in shock; had no perceptible pulse, blood pressure 50/0, temperature 96.0° F., marked pallor. He complained of severe pain in his ankles, and seemed to be quite weak. Adrenalin was given immediately, and the patient was made warm with blankets and an electric heater. A radio message was sent to the base, asking that plasma transfusion facilities be forwarded by plane. The patient was given 50 cc. of 50 percent glucose by vein, in an attempt to increase the blood volume, and was repeated in 3 hours. The adrenalin was repeated hourly and morphine was given as indicated.

When the extremities were examined, there was complete sensory and motor loss of the left lower extremity down to the lower third of the tibia, and partial sensory and total motor loss of the right to the same level. The ankles were considerably swollen with marked anterior angulation. There were bilateral fractures of the lower third of the tibia and fibula, and the talus and calcaneus of both limbs were shattered and fragmented. The upper third of the fibula was fractured in the left leg but not in the right. The sites were compounded through perforations about 4 cm. in diameter in the middle of both heels, with fragments of bone protruding. The loose pieces of bone that were

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immediately accessible were removed. The areas were then cleansed with soap and water, and washed with alcohol. Sulfanilamide tablets were powdered and the powder was poured and packed into the wounds. Sterile dressings and box splints were applied. There was much swelling and it was thought inadvisable to use any kind of traction at that time. Tetanus antitoxin (1,500 units) was given.

The plasma was dropped by parachute from a plane and retrieved from the sea. Up to this time the blood pressure had fluctuated from 60/40 to 70/45, with the pulse barely perceptible. At the time the plasma transfusion was started, the blood pressure was 70/40; the pulse extremely weak, and the rate 135–140. Blood plasma was given (250 cc.) and following this administration the pulse was rapid and weak, but appeared to be more regular. The blood pressure was 85/50. The blood plasma was repeated with the result that the blood pressure rose to 102/60, the temperature to 98.2° F., and the patient felt stronger. Again the blood plasma was repeated (250 cc.) making a total of 750 cc., resulting in more improvement of his pulse, color, and blood pressure (108/60). The patient slept fairly well; two doses of morphine were given during the night. The following morning the patient's blood pressure was 112/60, pulse 116, and temperature 98.8° F. The patient was transferred to a base hospital from the ship. This man had recovered from shock at the time of transfer.

The dried pooled plasma was used in this case. I believe that plasma has a definite advantage over whole blood in emergencies such as this because of the rapidity and ease with which it can be given, compared to the slow technic in giving blood transfusions.

TREATMENT OF LUNG ABSCESS

THE FEASIBILITY OF PHRENIC PARALYSIS COMBINED WITH PNEUMOPERITONEUM

By Lieutenant Commander Edgar Rioen, Medical Corps, United States Navy

A review of the literature reveals a variety of methods advocated for the treatment of abscess of the lung. Lung abscess usually originates as an area of pneumonitis or consolidation which liquifies with resulting cavitation. If cure is not effected the resulting complications include gangrene of the lung, empyema, hemorrhage, pyothorax, pleurisy, and abscess of the brain. If the condition becomes chronic, multiple abscess, bronchiectasis or pericarditis may ensue. Terminal death may be due to brain abscess, lobar pneumonia, sepsis or chronic amyloid disease. The mortality varies from 20 to 50 percent under present methods of treatment.

A small percentage of cases may and do resolve spontaneously on bed rest and general supportive treatment. If fusospirochetal organisms are present in the sputum, small doses of neoarsphenamine or sulfarsphenamine are especially effective when instituted before destruction of pulmonary parenchyma with cavitation has occurred. Eighty to ninety percent of all lung abscesses in adults are due to these organisms.
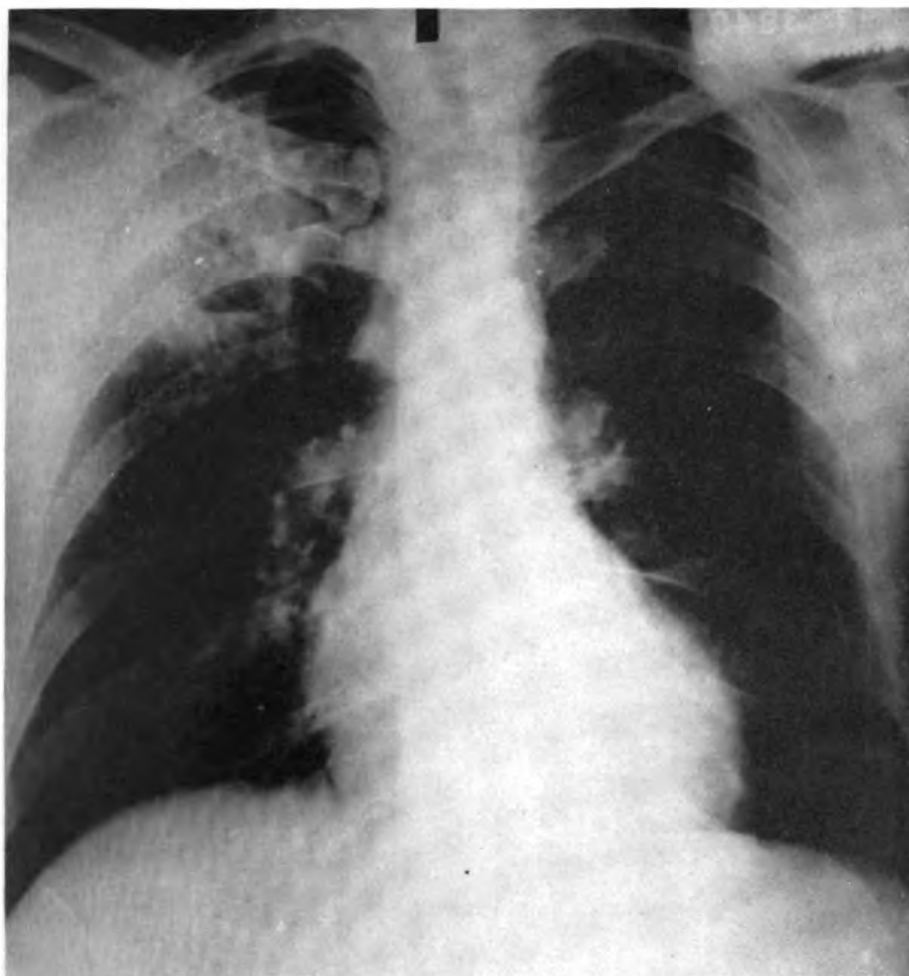
PLATE 17

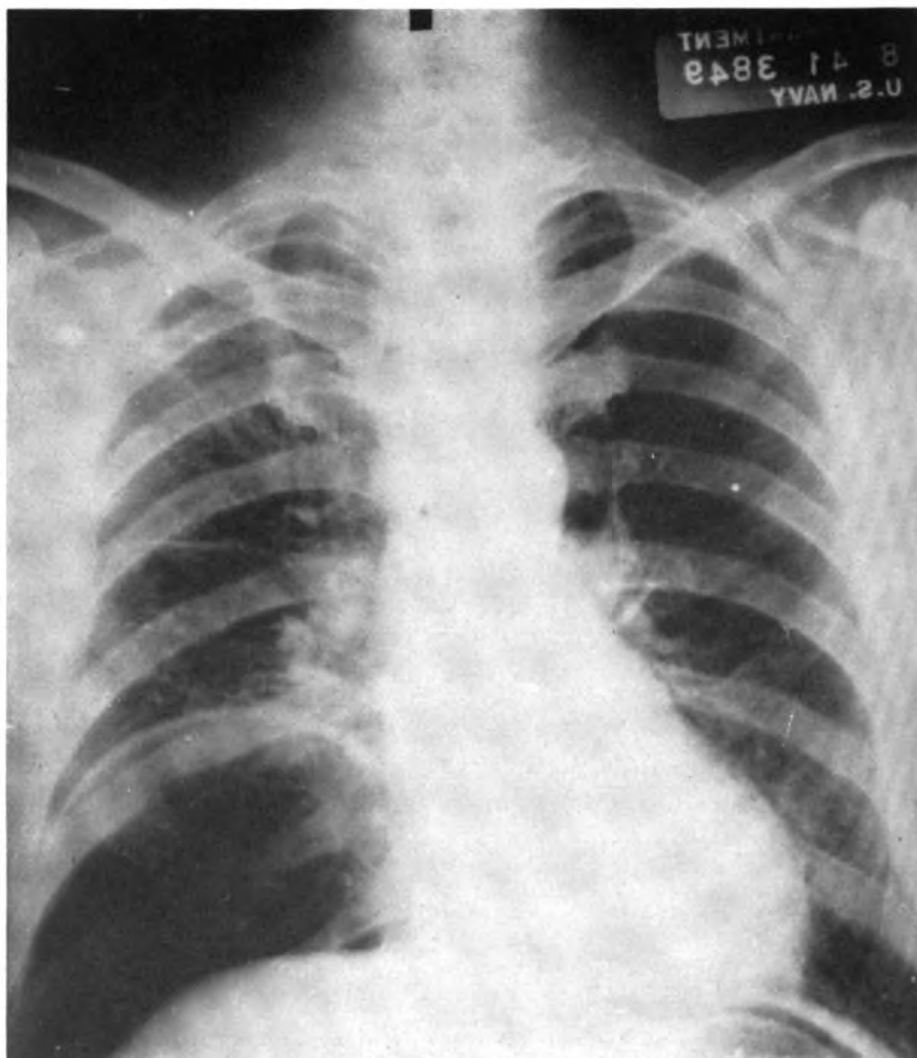FIGURE 1.—ABSCESS WITH CAVITATION IN RIGHT UPPER LOBE.

FIGURE 2.—RIGHT PHRENIC CRUSH PLUS PNEUMOPERITONEUM. SHOWING
CAVITY CLOSURE.

An acute abscess, especially of the smaller variety, after rupture into a bronchus has occurred, responds well to postural drainage. Postural drainage may often be advantageously supplemented by bronchoscopic aspiration. A large acute abscess which does not respond favorably to postural or bronchoscopic drainage within three to four weeks should be treated surgically. Too prolonged postural drainage often results in many of the complications already enumerated.

Some authorities dismiss artificial pneumothorax and phrenicotomy as of little or no value in the treatment of acute or recent pulmonary abscess. Collapse of the lung by means of artificial pneumothorax is, in fact, attendant to dangerous complications, especially if the abscess is peripheral in location. The most common complications of this procedure are empyema, pyopneumothorax, and bronchial fistula. Artificial pneumothorax may result in kinking of a bronchus, thus obstructing drainage. The best results have been obtained with artificial pneumothorax when the abscess is more centrally located.

Complete collapse of the lung, as used for pulmonary tuberculosis is contraindicated in the treatment of lung abscess. Such a procedure obstructs drainage, in this way delaying healing. Some authors advocate introducing just enough air to separate the pleural surface. This procedure is more rational but involves certain disadvantages. Frequent refills and frequent fluoroscopic examinations are necessary in order to carry out this method of treatment.

In previous publications dealing with the collapse therapy of pulmonary tuberculosis, the efficacy of phrenic paralysis supplemented by pneumoperitoneum for closing pulmonary parenchymal cavitation has been demonstrated. The advantages of this procedure can be safely applied to pulmonary suppuration with cavitation. By using this method of approach adequate but not total collapse of the lung is obtained. Thus the objectionable feature of artificial pneumothorax is eliminated, namely obstruction to pulmonary drainage because of total collapse. The combined procedures of pneumoperitoneum and phrenic paralysis accomplish two definite objectives. The elevated diaphragmatic leaf compresses the lung while at the same time the respiratory diaphragmatic excursions are eliminated. The direct result of this type of compression is drainage of inflammatory exudates from the pulmonary cavity and the bronchial tract. The phrenic paralysis provides immobilization and functional rest to the lung. One of the first clinical responses to this type of treatment is increased expectoration with diminished cough. The final end result is cavity closure.

CASE REPORT

History.—L. H., engineman, first class, retired, age 50, was admitted October 22, 1941, complaining of cough, elevated temperature, and loss of weight. The onset of the present illness began about 3 weeks prior to his admission, with a mild cough which gradually grew more severe. About 1 week prior to his being admitted, his cough became paroxysmal in type and was accompanied by some chest pain and elevated temperature. About that time he began coughing up large quantities of foul-smelling sputum which continued until his admission. He stated he had lost about 15 pounds in weight since the onset of his illness.

Physical examination.—Examination revealed a rather emaciated white male lying quietly in bed. His face was flushed, he was perspiring profusely, and . there was a fetid odor to the breath. On admission, temperature was 101.8; pulse, 112; and respiration, 24. Lung expansion was limited, right upper lobe; tactile fremitus was increased, right upper chest; impaired resonance was noted, right upper lobe; bronchophony was elicited on whispered voice, right infraclavicular region. The remainder of the physical examination is essentially negative.

Laboratory findings.—On October 27, 1941, the temperature was 104°; pulse, 110; respiration, 25; red blood count, 4,100,000; white blood count, 20,000; hemoglobin, 11 gm., 76 percent; neutrophiles, 95; juveniles, 2; band forms, 23; segmented 70; lymphocytes, 3; monocytes, 2; sedimentation index, 27 mm.; sputum examination (Gram stain); Gram-positive cocci in chains, 40 percent; Gram-positive cocci in clusters, 15 percent; fusiform bacilli, 15 percent; bacillus Vincent, 15 percent; Gram-negative rods, 5 percent; Gram-positive rods, 10 percent; acid fast stain, none found; Kahn, negative.

X-ray findings.—A bedside film of the chest, taken on October 27, 1941, revealed extensive soft type infiltration throughout the right infraclavicular region. Near the center of this area, there is a zone of increased density about 3 by 2 centimeters in size indicative of cavitation. Impression: Soft infiltration with cavitation in right upper lobe (see fig. 1). '

Progress notes.—October 28, 1941: Postural drainage instituted 10 minutes t. i. d.

November 25, 1941: Right phrenic crush done.

November 26, 1941: Pneumoperitoneum instituted.

December 10, 1941: Temperature 98.6°; pulse, 80; respiration, 20. Laboratory findings: Red blood count, 4,700,000; white blood count, 8,750; hemoglobin, 13.5 gm., 93 percent; neutrophiles, 53 percent; segmented, 53 percent; lymphocytes, 44 percent; eosinophiles, 2 percent; monocytes, 1 percent; sedimentation index, 12 mm.

December 31, 1941: An X-ray film of the chest was made. The cavity previously described was no longer discernable. There was very little surrounding parenchymal reaction compared to the film of October 27, 1941. The right diaphragmatic leaf was considerably elevated. Pneumoperitoneum was present (see fig. 2). Temperature, pulse, and respiration were within normal limits. Expectoration had ceased. There had been a gain of 20 pounds in weight.

CONCLUSION

Phrenic nerve paralysis supplemented by pneumoperitoneum provides a rational and effective method of treating acute abscess of the lung.

AVULSION OF THE BISCEPS TENDON FROM ITS RADIAL INSERTION [1]

REPORT OF A CASE

By Captain Frederick R. Hook, Medical Corps, United States Navy, and Lieutenant Commander Robert Maset, Jr., Medical Corps, United States Naval Reserve

Our interest in avulsion of the distal biceps brachii tendon, like that of many others, has been stimulated by Dobbie's (1) comprehensive review of this subject. In Dobbie's own case, the operation was performed on the seventh day post trauma, and he says much time was spent in an endeavor to expose the radial tuberosity before the attempt was abandoned. Plummer's case, reported by Dobbie, was repaired on the second day post trauma, and apparently there was a well-defined canal leading to the radial tubercle. In none of the other cases, reported by Dobbie, is the elapsed time between injury and operation given, though he states that in many of them it was several weeks to several months. G. I. Bauman (2) states that 3 or 4 days passed between the injury and repair. H. D. Sonnenschein (3) did his repair 5 days after the injury. Harry Platt (4) does not tell us how long after the trauma he repaired the tendon.

This case is being presented for several reasons, namely: the comparative rarity of the lesion, the relative ease with which we were able to expose the radial insertion, and the apparent importance of the time element in relation to the clear definition of the anatomical structures and ease of replacement of the ruptured tendon end.

The operative repair of the tendon was approached with some apprehension because of previous reports of the difficulty in isolating the tubercle, the number of important anatomical structures in the antecubital fossa, and the fact that a number of operators in Dobbie's collected series had been satisfied to suture the torn tendon end in other than its anatomical position.

In this instance the elapsed time between trauma and operation was just under 48 hours. The tendon end was bulbous, completely and cleanly torn from the radius at its insertion, and coiled up on the anteromedial aspect of the arm. The canal leading to the insertion was clearly visible, and at its end the tuberosity was palpable. There was no necessity to expose or retract any of the various delicate structures of the forearm. When the lower end of the brachialis was exposed, the canal, between it and the extensors of the forearm, leading directly to the radial tubercle lay in the middle of the field, and readily admitted the little finger. Suture of the tendon end to the tubercle was accomplished without difficulty by drilling two holes through the tubercle and employing a heavy braided silk mattress suture passed through the tendon and the two holes.

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[1] From the Surgical Service of the United States Naval Hospital, Bethesda, Md.

The larger vessels and nerves were palpated medial to the tunnel, but were not exposed. Only one nerve was observed lateral to the channel, the superficial branch of the radial.

<center>CASE REPORT</center>

History.—G. B. S., a 37 year old electrician, was admitted to the Naval Hospital, Washington, D. C., on April 11, 1941, complaining of pain and loss of function of the left elbow of 1 day's duration. The past and family histories were negative. The patient states that on the previous day, while riding on the back of a truck, he was hanging on to a stanchion with the left hand, with the elbow partly flexed, when the truck stopped abruptly throwing him forward and putting a sudden severe strain on the biceps. He felt a sharp pain in the elbow at the time and was unable to flex the joint without aid from the right hand. He was taken to the local dispensary, where first-aid treatment was administered and was then transferred to this hospital for further treatment on the following day.

Physical examination.—The general physical examination was essentially negative. The left arm was held at the side with the elbow flexed. There was no atrophy of the shoulder girdle. The bulge of the biceps on the left side was higher than that on the right; and below it, on the anteromedial aspect of the arm, was a smaller mass, somewhat reddened and tender. Acute flexion and extension of the elbow was painful. There was definite weakness of flexion, and slight loss of supination. There was very little impairment of the triceps function, pronation, or of finger strength. The blood findings, Kahn, and urinalysis were normal.

Diagnosis.—A diagnosis of avulsed biceps tendon was made and the patient was taken to surgery the day following admission, approximately 48 hours after injury.

Surgical procedure.—A 3-inch longitudinal incision over the antecubital fossa was made and considerable hemorrhage just beneath the fascia was noted. As soon as the lower end of the brachialis was exposed, the canal leading between it and the extensors to the radial tubercle stood out very clearly. It readily admitted the little finger. The tendon was completely torn from the radius and the lacertus fibrosus, and lay coiled on the inner side of the lower end of the arm. Two holes were drilled through the tuberosity, and the tendon was held in place by a braided silk mattress suture. The wound was closed in layers and a posterior molded plaster splint applied from hand to axilla with the elbow flexed at 90°.

Postoperative course.—Finger motion was encouraged from the start. His course was quite uneventful. Sutures were removed on the seventh day, and plaster on the twenty-first day. He was discharged on the tenth day. On the day of discharge there was considerable residual swelling in the antecubital region. Passive flexion of the elbow to 45° (from 90°) was possible, finger motion was excellent, but there was almost no pro-supination.

MAY 10, 1941.—Elbow motion 60°–150°, no supination, pronation 20°, no tenderness, good grip, pain in wrist on pro-supination.

MAY 24, 1941.—Circumference of left arm ¼ inch less than right; just below elbow circumference of left forearm ½ inch greater. Elbow motion lacks 30° of full extension and 10° of flexion. There is about 40° of pro-supination. Patient permitted to do everything but heavy lifting.

June 7, 1941.—Left arm still ¼ inch smaller than right, circumference of left forearm ¼ inch greater. Elbow motion normal. Pronation 80°, supination 40°. Excellent biceps power and grip. To resume usual work.

July 7, 1941.—Still ½ inch of swelling of left forearm. Supination 70°, pronation 50°; all other motions and strength of entire extremity normal. Circumference of biceps equal on both sides. Patient has resumed his usual work. He is climbing poles and carrying heavy cables without difficulty.

SUMMARY

A case of avulsion of the distal tendon of the biceps brachii is presented.

The preoperative diagnosis of this condition presents no difficulty in a case of complete rupture.

The ease with which the tendon may be replaced on the radial tubercle is inversely proportional to the length of time elapsing between trauma and operation. In fresh cases exposure of the tubercle is not difficult, nor is there necessity of disturbing other anatomical structures.

We believe that anatomical replacement of the distal tendon end is best if it can be accomplished.

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URTICARIAL AND ERYTHEMA MULTIFORME-LIKE ERUPTIONS FOLLOWING INJECTIONS OF YELLOW FEVER VACCINE

By Lieutenant Commander Marion B. Sulzberger, Medical Corps, United States Naval Reserve, and Lieutenant, junior grade, C. Asher, Medical Corps, United States Navy

The purpose of this series of reports is to call attention to certain forms of skin reaction which may, on occasion, be elicited by some of the newer immunizing agents now in routine use in the United States Navy. Our report considers only the practical, clinical aspects; and does not include scientific analysis of the mechanism of the reactions. Nor were we able to analyze the causal agents for the purpose of discovering the probable etiologic fractions or constituents. We cannot emphasize too strongly that the reactions we here describe are relatively mild, are uncommon, occurring only in exceptional cases, and cannot by any means be construed as an argument against the value and continued use of the prophylactic agents concerned.

At the United States Naval Hospital, Brooklyn, we have, in recent months, observed three cases in which yellow fever vaccine was the presumptive cause of more or less generalized urticarial and erythema multiforme-like eruptions.

These cases are reported in order to add this form of skin reaction to the list of by-effects already known to have been caused by yellow fever vaccine (malaise, joint pains, fever, neuralgias, hemorrhages, abdominal pains, diarrhea, etc.). All these previously recognized and described forms of reaction also occurred in our material, in approximately the expected incidence and degree (1).

CASE I

J. F. J., Fireman, first class, U. S. N., was admitted to the hispital from the U. S. S. *Dahlgren* on July 24, 1941, with the diagnosis of allergy to yellow fever vaccine. The patient was 25 years of age and in good general health. There was no allergy or familial allergy (atopy).

On July 17, 1941, the patient had received a routine prophylactic injection of the stock yellow fever vaccine (17 D). He was well until the evening of July 23 (six days after the injection). That evening he experienced a rather severe "stomach ache" following the evening meal. About one hour after retiring, he awakened with burning and itching over the entire body. On the morning of July 24 there was general malaise, joint pains, and a throbbing headache.

On admission, the skin presented round and oval urticarial lesions of various sizes, ranging from a small pea to large palm-size. Some lesions assumed annular forms, with depressed centers and edematous, reddish or pinkish edges. The principal sites of the eruption were the face, the nape of the neck, the neck back of the ears, the shoulders, the flexures of the elbows and knees, and the extensor surfaces of the lower legs. The eyelids were swollen and there was some conjunctivitis. At the time of admission, the oral temperature was 99.4, the pulse 86, and the respiration 18. The blood showed only 2 percent eosinophilic cells. The retro-auricular, axillary and inguinal lymph nodes were slightly enlarged, but not tender. The entire picture was strikingly similar to that presented by a mild form of serum sickness, as it commonly appears six days after the injection of a foreign serum. The lesions responded to an injection of adrenalin with temporary improvement.

After three days of symptomatic treatment (forced fluids, bed rest and antipruritic lotion), the temperature was normal and the skin eruption and the subjective symptoms had disappeared. As is the rule in this form of eruption, the skin-test (scratch) with yellow fever vaccine was inconclusive (questionable reaction).

CASE II

J. C. S., Seaman, first class, U. S. N., was admitted to the hospital from the U. S. S. *Seattle* on July 30, 1941, with the diagnosis of impetigo contagiosa. The patient was 23 years of age and in good general health. There was no personal or familiar history of allergy.

On July 28, 1941, patient had received a routine, prophylactic, subcutaneous injection of the stock yellow fever vaccine (17 D).

On the morning of July 31 an urticarial eruption appeared. The lesions varied from small bean- to palm-sized, and were scattered over the trunk and extremities. There were several lesions on the forehead. The principal sites involved were the extensor surfaces of the legs and feet and the dorsa of the hands. The conjunctivae were injected. The oral temperature was 101° F., the pulse 86, and the respiration 20 per minute.

The eruption faded temporarily after an injection of adrenalin.

Under palliative measures similar to those given in Case I, the eruption disappeared and the temperature and general condition returned to normal in 2 days.

<div align="center">CASE III</div>

F. G., Seaman, first class, U. S. N., age 31, was seen in consultation on Thursday, July 31, 1941. He stated that the night before he had begun to experience an itching sensation over the entire body. This was followed by the appearance of red splotches over the chest, axillae, abdomen, neck, face, arms, hands, fingers, thighs, legs and feet. The patient reported to sick bay of the Receiving Ship at New York, and was then referred to the dermatologic service of the United States Naval Hospital.

Examination revealed reddened urticarial lesions disseminated over a large part of the body surface. The lesions presented irregular, sloping borders, and varied in size from one to several centimeters.

On study of the case, the only possible discernable cause was the fact that on July 23, 1941, or six days before the onset of the eruption, the patient had received the standard prophylactic injection of yellow fever vaccine.

In this case there were no general systemic reactions, such as headache, fever, or aching joints, etc. There was no history of any other form of allergy, either in the patient or in his family.

The eruption disappeared rather gradually and the patient's skin was normal again about 10 days later the first appearance of the rash.

<div align="center">DISCUSSION</div>

The yellow fever vaccine employed in all these cases was the standard material furnished the Navy by the International Health Division of the Rockefeller Foundation; and known as 17 D.

The material contains:
1. The attenuated virus
2. The chick embryos on which it has last been grown
3. Pooled human serum and distilled water as vehicles and diluents.

We are unable to say which of these constituents or which of their possible combinations was the cause of any of the eruptions observed. However, the clinical picture, the incubation period and the course of the manifestations suggest a sensitization or allergic mechanism rather than an infectious or direct virus effect.

This form of cutaneous sensitization must be rare, as somewhere between 2 million and 3 million doses of this vaccine have been given, and no report has been made of cutaneous reactions such as here described.

It is possible, however, that cases of this relatively ephemeral skin eruption may have been missed.

Since the proteins of the pooled human serum are surely not greatly denatured in the preparation of the virus for injection, it is unlikely that the human serum is responsible for the reactions. There is greater likelihood that the reactions are due to a sensitization either to chick embryo material or to virus protein itself.

It has not been conclusively proven, of course, that these reactions were due to the injections received. Nevertheless, this causal relationship appears to be highly probable for the following reasons:

1. None of the patients had ever had a similar episode, and none had ever had any form of allergic skin eruption or other allergic disease.

2. Each of these three patients came from different ships, and each had received the injection of different lots of vaccine, at different sick bays, and had come down with the rash at a different time, thus practically precluding contamination or an infection or intercurrent contagion as causes of the three cases.

3. The eruptions were of the urticarial and multiforme type, and both the rashes and the general manifestations were quite characteristic of mild serum disease and of other mild forms of sensitization to foreign biologic agents.

4. In all three cases there was no possible ascertainable cause other than the injection of vaccine; no other illness, no ingestion of drugs or other such exposure, no alterations of habit, of environment or of diet to account for the appearance of the eruption.

5. The incubation period of the dermatoses was typical of the delayed response (incubation of sensitization) in two of the cases (six to seven days—cases I and III), and of an accelerated response in one case (36 hours—case II).

6. The course and the accompanying findings were both identical with those of mild serum sickness.

This report is submitted in order to call attention to the possibility of this mild form of allergic cutaneous reaction after injection of yellow fever vaccine. If our observations are correct, other cases will now probably come to light; and these may permit further studies on the nature and mechanism of this particular form of response.

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CHRONIC URTICARIA FOLLOWING A SINGLE INJECTION OF TETANUS TOXOID

By Lieutenant Commander Marion B. Sulzberger, Medical Corps, United States Naval Reserve

The above paper reported 3 cases of urticarial and erythema multiforme-like reactions following injections of yellow fever vaccine (1). These reactions were mild and evanescent and disappeared in three to ten days.

The present report deals with a case of chronic urticaria which followed, not yellow fever vaccine but an injection of tetanus toxoid. There is then no relationship between the subject of the present report and the subject of the preceding communication, except that both papers deal with uncommon forms of skin reaction following the injection of new prophylactic agents in general use in the Navy.

Chronic urticaria following the injection of tetanus toxoid has recently been reported and very thoroughly studied by Cooke, Hampton, Sherman and Stull, (1). These authors gleaned from the literature reports of three previous cases of urticaria or urticarial reaction following a second injection of alum precipitated tetanus toxoid. The details submitted on these three earlier cases were meagre. In connection with the present report it is noteworthy that Herman Gold, who reported one of the first cases, expressly stated that the hives developed in a nonatopic subject, one-half hour after the second injection of the toxoid.

While the data in these three cases is scant, Cooke and collaborators have added a very thoroughly studied case. In their patient G. C., an atopic individual, the hives appeared after the second injection of toxoid. The reaction was allergic, was accompanied by specific skin-sensitizing antibodies (Prausnitz-Küstner antibodies) and was apparently due to sensitization to proteoses in the peptone broth from which the toxoid was prepared. The eruption was persistent and the widespread urticaria continued for at least six months after the injection, without further known exposure to the toxoid. In addition to the instance of chronic generalized urticaria, Cooke and co-workers report four cases of allergic local reactions to second or third injections of toxoid.

Dr. Cooke has stated that he has observed two cases of chronic intractable urticaria which developed within 2 weeks of a second injection of toxoid, and which continued rather severely for at least 6 months (2). Still other cases of allergic and urticarial reactions attributable to tetanus toxoid have been reported, notably by Parish and Oakley (3), by Whittingham (4), and by Cunningham (5), in Great Britain; and by Newell and McVea (6), and Bigler and Werner (7), in the United States.

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It is impossible here to discuss the many theoretical points and the interesting experimental and immunologic data presented by Cooke and his co-workers. The original reference is recommended to those interested in this subject. It may be well, however, here to mention that the sensitivity to the toxoid is not necessarily directed to the same ingredient in each case. In most cases there seems to be an allergic sensitization to constituents (proteoses) of the peptone of the broth, but in other cases the patients are apparently allergic to proteins of the tetanus bacillus or its products (toxin).

The object of the present report is twofold: first, to call attention once again to the possibility of chronic urticaria following the injection of tetanus toxoid; and second, to describe an example of such a sequence of events in a case presenting certain hitherto unreported features.

It is not the purpose of this report to add to or to confirm the results of Cooke et al. There was, unfortunately, no opportunity to duplicate or to extend the series of immunologic experiments of those authors.

<h3 style="text-align:center">CASE REPORT</h3>

Patient A. F. McC., Private, U. S. M. C., a white male, 23 years old, was admitted to the hospital on May 16, 1941.

The previous history was irrelevant with the possible exception of the fact that the patient had had catarrhal fever on February 24, 1941. There was no history of allergy in the patient's family. He himself had never suffered from any allergic disease nor from hives nor from any form of cutaneous eruption. On Wednesday, April 23, 1941, the patient had received the routine first intramuscular injection of 0.5 cc. alum precipitated tetanus toxoid at the Navy Yard Dispensary. On Saturday, April 26, 1941, or 3 days after the toxoid injection, the patient began to "itch all over" and broke out in typical hives on face, arms, and over the entire trunk. These hives persisted, with old lesions disappearing and new lesions appearing constantly. Ordinary palliative treatment was ineffectual.

On admission to the hospital the patient was found to be in good general health. There was no evidence of illness or abnormality of any system, with the exception of the highly pruritic urticarial eruption. Urticarial lesions, varying in size from a pea to a large egg, continued to appear on various parts of head, trunk and extremities. On some days there would be hundreds of wheals, on others only a dozen or so.

All investigations designed to discover a possible etiology other than the tetanus toxoid were futile. There were no demonstrable active foci of infection in teeth, tonsils, sinuses, chest, abdomen or genito-urinary tract. Rigid and protracted elimination diets shed no light and did not bring about improvement. In addition to dietary measures, the various forms of treatment included purging, forced fluids, calcium injections, histaminase by mouth, dilute hydrochloric acid by mouth, ephedrine by mouth, administration of gastro-intestinal absorbents, autohemotherapy and intravenous injections of combined typhoid vaccine. The urticaria ran its course apparently unaffected by all these attempts. At the end of 4 months the eruptions were less extensive

and severe, but even now, six months after the injection, no day passes without the appearance of half a dozen or more hives.

(This chronic course, with very gradual diminution of the eruption, seems fairly characteristic of this form of reaction. At any rate, it is identical with the events observed by Cooke in two other cases. If these cases are based on hypersensitivity to proteoses, then the continuation of reaction may be due to repeated exposures to new proteoses derived from foods or inhalants or perhaps even those of endogenous origin. Another explanation is also tenable; namely, that the injected alum precipitated toxoid forms a deposit from which small amounts of allergen continue to escape into the circulation over a long period of time. Whether either of these or some other explanation be the true one, the protracted course has now been observed in three cases and represents the most unpleasant feature of this particular reaction.)

On July 28, 1941, the patient and three control subjects were scratch-tested with the alum precipitated tetanus toxoid. The patient reacted with a wheal of 1 cm. diameter and a flare of 3 cm. diameter. There was no demonstrable reaction in the control subjects. Intracutaneous testing with 0.02 cc. of alum precipitated tetanus toxoid was performed on August 22, 1941, in the patient and in 2 new control subjects. Again the patient reacted with a wheal and flare; the controls did not. Two days later the patient's blood was examined for passive transfer antibodies (Prausnitz-Küstner experiment. The experiment was performed on two normal test subjects. No passive transfer reagins were found.

SUMMARY

1. A case of chronic urticaria of over 6 months' duration is reported. The eruption began three days after the subcutaneous injection of 0.5 of alum precipitated tetanus toxoid.

2. There was no history of any previous attack of urticaria, of any other form of skin eruption or of any allergic disease in the patient or his family.

3. No possible cause for the urticaria could be found, except the injection of the toxoid.

4. The patient had a moderately strong urticarial wheal reaction to skin tests with the toxoid.

5. The present case differs from the case studied by Cooke and co-workers in three important respects:

a. The eruption followed a first injection of toxoid (not a second or subsequent injection).

b. The patient was not an atopic individual (i. e., was not a hay fever or asthma subject, and not from an allergic family), and

c. No reagins (passive transfer antibodies) could be found in the patient's blood.   (For discussion of these points see reference 8.)

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MUCOCELE OF THE APPENDIX

By Captain M. D. Willcutts, Medical Corps, United States Navy, and Commander E. P. Kunkel,
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Two cases of mucocele of the appendix within the period of 10 days focused our attention on this rather rare disease. Virchow (1) described mucocele of the appendix in 1863. Since that time it is doubtful whether as many as 300 cases have been reported. Castle (2), in a total of 13,158 autopsies, found 28 cases, a frequency of about 0.2 percent. Corning (3), of 925 appendices examined pathologically, found 5 mucoceles, a frequency of about 0.68 percent. Mayo and Fauster (4) reviewed the surgical cases encountered at the Mayo Clinic from 1917 to 1930 and found 76 mucoceles in 31,200 cases in which the appendix had been removed, a frequency of about 0.24 percent. Jirka and Scuderi (5) reported on 9,535 appendices removed at the Cook County Hospital from July 1928 to January 1937, and found 22 cases, a frequency of 0.23 percent.

Mucocele of the appendix is an accumulation of a mucous or mucoid secretion in either the lumen, the wall, or the mesenteric attachment of the vermiform appendix.

The underlying cause is occlusion of a portion of the lumen of the appendix due to residuals of recurring infections or obstructive factors from without. The mucous glands continue to secrete and distention occurs.

Secretion of mucus is in excess of its absorption, or distention would not occur. The mucocele may become so distended that it ruptures, causing pseudomyxoma peritonaei; or the mucous glands may atrophy as a result of pressure, and thereby cease secreting mucus. In one of our cases, the mucocele ruptured into the peritoneal cavity. Whether or not these cases develop pseudomyxoma peritonaei depends on whether or not the mucous membrane lining of the mucocele has been destroyed by pressure atrophy. Our case of rupture 1 year following operation remains in good health and has no signs or symptoms referable to the abdomen.
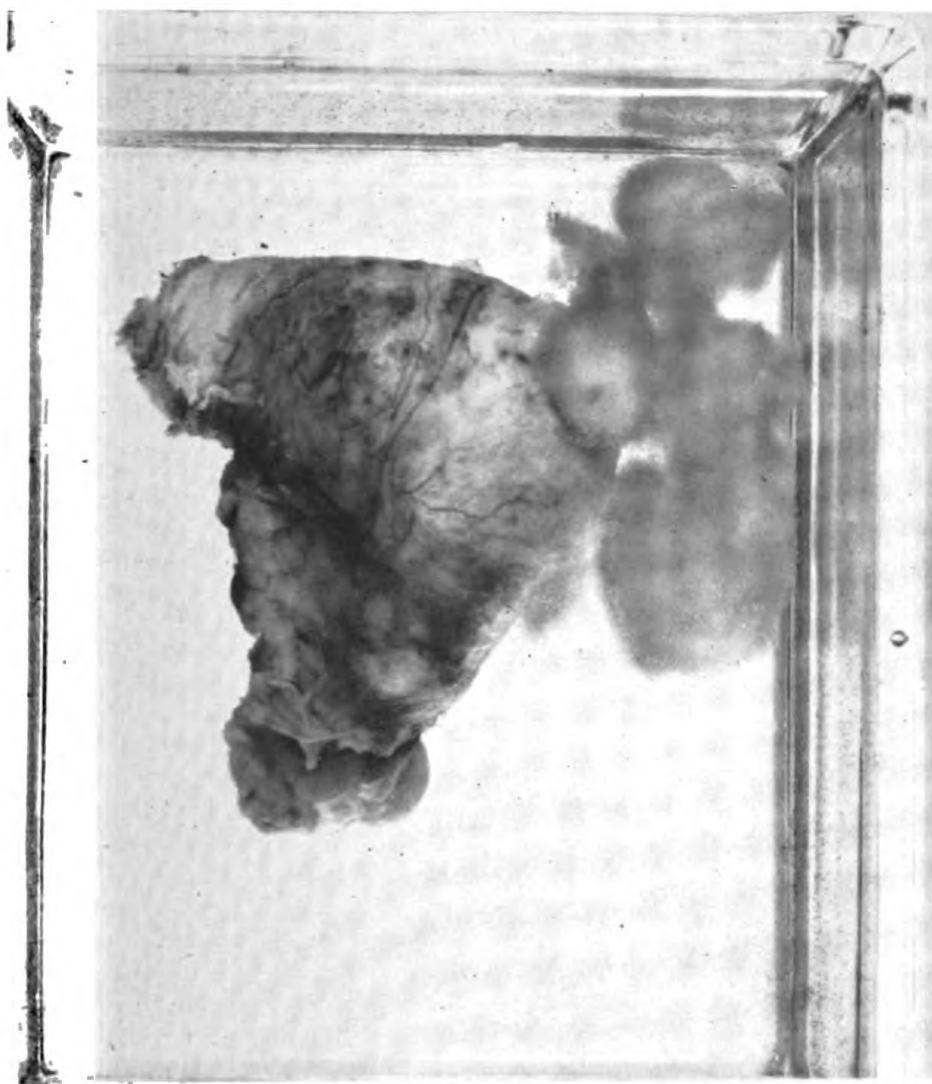
FIGURE 1.—SHOWING MUCOCELE WITH MUCINOUS CONTENTS POURING FROM
PERFORATION.

The symptoms are vague and not characteristic except for a history of abdominal distress, and, usually, a mass which can be palpated in the right lower abdominal quadrant. The diagnosis of mucocele of the appendix, or pseudomyxoma peritonaei of appendiceal origin, is usually made at the time of operation with a preoperative diagnosis of some other intra-abdominal condition, or during a routine autopsy.

The treatment of mucocele of the appendix and pseudomyxoma peritonaei is surgical. The mucocele should be removed with extreme caution to avoid rupture. In cases of mucocele of the appendix with pseudomyxoma peritonaei, all of the remaining parts of mucocele should be removed along with as much mucoid gelatinous material and implants as possible. Following this x-ray therapy may be given.

CASE I

J. H. G., age 49, was admitted November 18, 1938, complaining of a severe pain in the right lower quadrant. For 3 months prior to the admission, the patient had been nauseated, and on numerous occasions had pain in the right lower quadrant. Two days prior to the admission, the pain and nausea became aggravated following the lifting of a trash can. After a few hours the pain became dull but remained constant.

Physical examination.—Essentially negative except for the abdomen which was moderately distended. There was tenderness and rigidity on the right lower abdominal quadrant. Temperature 98. Pulse 80. Respiration 18. Blood pressure 122/68.

Laboratory examination.—Urinalysis: appearance amber; reaction acid; specific gravity 1025; albumin negative; sugar negative; microscopic examination negative. Blood report: red blood count, 4,600,000; hemoglobin, 13 gms.; white blood count, 11,300; bands, 7; segmented, 56; lymphocytes, 19; eosinophiles, 12; basophiles, 1; monocytes, 5.

Procedure.—The patient was operated on November 18, 1938. Anesthetic, local ½ percent procaine. Upon opening the peritoneum, a large amount of odorless mucoid material, which had its origin from a large ruptured appendiceal mucocele (fig. 1) gushed forth. The mucocele, in shape and size, resembled an average sized pear. There was a 1 cm. perforation in the mucocele. The appendix was removed, and peritoneum closed without drainage.

Pathological report.—Gross examination: Specimen consists of a triangular, cystic appendix measuring 7 x 5 x 3.5 cm. At the apex of the cystic mass, there is a perforation 1 cm. in diameter through which is extruding a string of thick, yellowish-white mucoid material. On section, the walls are white and the cavity is lined with what appears to be a remnant of mucous membrane. The cavity is filled with yellowish-white mucoid material. Microscopical examination: Sections from the proximal and distal ends of the appendix show a thin muscularis and a rather thick, fibrous submucosa. Both are heavily infiltrated with small round cells, plasma cells, and numerous scattered eosinophils. There is some mucoid degeneration of the inner muscular coat. The mucosa shows a broken-up papillary arrangement of the thin-celled stratified columnar epithelium. A number of the cells contain globules of mucoid material. The lumen is filled with thick, blue-staining mucoid material in which are remnants of the atypical mucosa and numerous large eosinophils.

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Pathological diagnosis: Ruptured mucocele (myxoglobulosis of von Hanseman) of the appendix.

Course.—The patient had an uneventful convalescence and was discharged on January 3, 1939. He has had no further symptoms.

CASE II

M. P., age 39, admitted on November 23, 1938, with a diagnosis of chronic appendicitis. At the time of admission, the patient had no complaints. About 11 months prior to the admission, he was seized with a rather severe pain in the abdomen. The pain was localized about the umbilicus and did not radiate. There was no nausea, vomiting or diarrhea. He was examined by a physician in Singapore who made a diagnosis of acute appendicitis, and was hospitalized for 48 hours, during which time all symptoms subsided. Since that time he has enjoyed good health. Due to the fact that his duties might remove him from competent medical aid, he desired to have his appendix removed.

Physical examination.—Essentially negative except for pain on deep pressure over McBurney's point.

Laboratory examination.—Urinalysis: appearance, amber; reaction, acid; specific gravity, 1019; albumin, negative; sugar, negative; microscopic, negative. Blood report: red blood count, 4,800; hemoglobin, 13.5 gms.; white blood count, 6,900; bands, 2; segmented, 62; lymphocytes, 26; eosinophiles, 6; monocytes, 4. Repeated stool examinations were negative for ova and parasites. The blood Kahn and Wassermann were negative. Sedimentation rate (Cutler) 6 mm. in 60 minutes. The x-ray plate of the abdomen was negative.

Procedure.—The patient was operated November 28, 1938, using local ½ percent procain anesthesia. The abdomen was opened through a transverse incision. The distal half of the appendix was indurated and enlarged to the size of a Concord grape. There were two small discrete cyst-like tumors in the appendiceal mesentery opposite the middle third of the appendix.

Pathological report.—Gross examination: The specimen consists of an appendix measuring 10.5 x 1.1 cm. The distal third is swollen, edematous appearing, and in the small section of the meso-appendix is an ovoid cyst adjacent to the wall of the appendix. It measures 1.5 x 1.5 x 1.2 cm. In the proximal two-thirds the serosal vessels are moderately congested. Section through the distal third shows the lumen to be large; and the walls, white and fibrous appearing. Adjacent cyst is fibrous walled and filled with yellowish-white mucoid material. At the extreme tip, the lumen of the organ and the cyst are seen to be connected by a narrow, slit-like opening. In the proximal portion the walls are thickened, fibrous, and the lumen is small and contains a small amount of fecal material. Microscopical examination: Sections of the appendix show the proximal third to be about normal in diameter. The walls are thick, fibrous, and fatty, showing a moderate infiltration of small round cells. There is practically no lymphoid tissue present. The mucosal layer is thin, the stroma being fibrous and the epithelial cells of the gland are distended by mucoid material. The lumen is small and contains shreds of cast off mucosa and a few red blood cells. At about the junction of the proximal and middle thirds, in the outer wall of the appendix, a mucous cyst begins which extends to the distal end where there is a small communication with the lumen of appendix. The lumen of the distal two-thirds is large and is lined by atrophic mucosa. The cyst is filled with blue-staining mucinous material in which are a few dark blue-staining granules and scattered cells with dark nuclei and eosinophilic cytoplasm. The cyst lining, for the most part, is connective tissue, but here and there is a strip of modified columnar epithelium in which the cells are very thin spindles, a few of them

containing a globule of mucoid material. The outer layer of the cyst is connective tissue which is continuous with a thin layer going around the appendix proper. The muscular coats of the appendix go between the cyst and the appendix proper. There is considerable round cell and eosinophilic infiltration in all of the walls.

Pathological diagnosis.—Mucocele of the appendix.

Course.—The patient had an uneventful convalescence and was discharged on December 8, 1938. All track of this patient has been lost since discharge.

CONCLUSIONS

1. Two cases of mucocele of the appendix are reported.

2. Mucocele of the appendix is a clinical rarity. Its incidence is about 0.24 percent.

3. The diagnosis is rarely made before operation.

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PELVIC ENDOMETRIOSIS

A CASE REPORT

By Lieutenant Commander E. T. Knowles, Medical Corps, United States Navy

One encounters frequently when doing family practice in the United States Navy, a relatively common disease of the female pelvis, pelvic endometriosis. It has been reported as occurring in some degree about once in every ten gynecological laparotomies. Meigs (1) emphasizes the increased frequency of this disease in his private practice and notes an incidence of endometriosis in 16.7 percent of all gynecological cases operated upon and 32.2 percent of all abdominal gynecological cases. His theory of causation of this increased incidence is that the hormones estrin and progestin cause a growth and functional change in the endometrium, a preparation for pregnancy which should in a normal female be utilized. However, in modern woman, late marriage (average of 26 years), contraception (in 66.6 percent), and the like, allow a prolonged menstrual life without interruption (all but three of a group of 100 cases menstruated ten years before the birth of a child). Under too prolonged and uninterrupted stimulation of the hormones, estrin and progestin, unutilized cells of the celom (the derivation of the tubes, cervix, and uterus) may become müllerian, or uterine, and thus produce endometriosis, while even under shorter stimulation the epithelium of the

patient with stigma of underdevelopment (75 percent of a group of 100 cases) may develop endometriosis. This favors the theory of Iwanoff, and Meyer, who predicated a development of cells of the celom, the predecessor of müllerian epithelium.

J. A. Sampson (2) introduced the term "endometriosis" in 1927, to designate varied ectopic adenomatous growth of the female pelvis whose histologic structure and physiology are identical with the endometrium. Other terms that have been used to designate this entity in its various locations are fairly numerous: Sampson's tumor, adenomyoma (Rokitansky), adenosis, adenomyosis (Frankl), adenofibroma cysticum (Iwanoff), tarry or chocolate cysts, mullerianoma and mulleriosis (Bailey), endometroid tumors, etc.

Pelvic endometriosis is the term generally used to differentiate the intrapelvic from the extrapelvic lesion. The latter may occur in many places outside the pelvic region: in abdominal scars, the umbilicus, inguinal region, large and small intestine, appendix, vulva and perineum and in more distant organs such as the lungs and arm muscle.

The intrapelvic lesions occur in the uterine wall (adenomyosis); the ovary (chocolate cyst); the pelvic peritoneum, especially of the rectovaginal septum and in the cul-de-sac; in the uterine and ovarian ligaments; in the pelvic lymph glands; and adjacent pelvic organs, the bladder and rectum. The distribution of the lesions in the pelvis would favor the implantation theory of Sampson as they are found in close anatomical relation to the structure about the tubal fimbriae from which openings the menstrual endometrium could escape.

CASE REPORT

Mrs. G. D., a white, American, married female, age 31 years, first reported for treatment on July 2, 1938, with complaints of gas pains in the stomach which were recurrent for the past 5 years, and constipation. The family and childhood histories are irrelevant. She had no previous operations.

The menarche appeared at 15 years of age. The menses occurred regularly at about every 28 days, the flow lasting from 5 to 6 days. There was no amenorrhea, menorrhagia, nor metrorrhagia but from the menarche she had noted some pelvic pains with her menses but thought that they were to be expected. The last period began June 23, 1938, and it continued 1 week and the flow was moderate.

Out-patient history.—Upon reporting to the clinic she complained of gaseous distension and pain in the abdomen recurring three or four times monthly for several days at a time and coming on 2 or 3 hours after meals and localized to the lower abdomen. This condition had gradually improved on a meat-free diet with only occasional gaseous distension and pain after eating meat or greasy foods and which was relieved by drinking a glass of warm water.

However, about a week ago, June 25, 1938, 2 days after the onset of her last menses, and after an evening meal consisting of vegetables and pork, she had gaseous distention, lower abdominal pain, headache, and a temperature of

99.6° F. This was relieved by salicylates and cathartics. Since then the patient has felt better but feels tired and has no appetite. The patient has been constipated for the last 5 years and she has to take mineral oil frequently for relief.

Physical examination.—The patient was an undernourished female of 31 years of age, in no apparent pain. There were a few dry nonpersistent rales in both apices; the lungs were otherwise normal. The abdominal musculature was thin and poorly developed. There was slight tenderness on deep pressure over the gallbladder but Murphy's sign was not present. There was a small tender mass in the right lower quadrant about 2 inches below McBurney's point and there was also tenderness in the right midlumbar region about 2 inches to the right of the midline of the back.

By pelvic examination the uterus was small, acutely retroflexed and deviated to the left where it appeared to be fixed low in the pelvis. There was a lemon sized, slightly tender, movable mass in the right fornix; the adnexae were not well made out. The cervix was nulliparous.

Laboratory report.—Urinalysis and complete blood count were within normal limits. The sedimentation test showed a sedimentation of 10 mm. in 60 minutes. x-ray examination of the chest and cholecystogram showed no abnormalities.

The following diagnoses were considered:

1. Malnutrition.
2. Chronic pelvic inflammation with:
   (a) A right tubo-ovarian mass.
   (b) Adhesions from the uterus to the pelvic floor.
   (c) Sterility.
3. Chronic cholecystitis (undetermined).

The patient was prescribed a high caloric high vitamin diet with fats restricted, and hot water douches three times daily.

The patient gradually improved under treatment. Her appetite was good and she increased from 94 to 97½ pounds in weight but complained of pain in the abdomen for 4 of the 6 days of her menstrual period which began on July 21, 1938; the flow was moderate in amount. The treatment was continued and upon reporting to the clinic on September 20, 1938, her weight had increased to 100 pounds. However, she complained of severe aching pains in the lower abdomen during her last menses which began September 6, 1938. This pain was present during the first 3 of the 4 days of flow; the period was ahead of time. Her temperature was 99.4° F. and she complained of a frequent sensation of weight and distension low in the abdomen which was partially relieved by rest. The pelvic mass appeared larger than at the previous pelvic examination. It was irregular and putty-like in consistency and was anterior to the uterus.

Laparotomy was advised at this time because of the poor result from medical treatment, the gradual increase of the size of the tumor, and the increasing severity of the patient's symptoms. The patient entered the hospital on October 30, 1938, for operation.

The chief complaints at this time were:

1. Severe lower abdominal pains with the last four menstrual periods.
2. A feeling of weight and distension in the lower abdomen and pelvis for the last month.
3. Pain radiating down the right thigh.

Interval history.—The patient's last period began October 25, 1938, 2 weeks late; and preceding the onset of the flow, she began to have a dull aching pain in the right lower abdomen below and to the right of the umbilicus, with swelling in this area. The flow continued for 4 days and it was moderate. The abdomi-

nal pain and distension continued up to the present time with pain radiating at times down the right leg.

Physical examination.—The abdomen was moderately distended and tympanitic throughout, with slight tenderness on deep palpation below and to the right of the umbilicus. Pelvic examination revealed a small uterus in first degree retroversion flexion with deviation of the body to the left due to a slightly tender mass in the right fornix. This mass was about the size and shape of an orange and of putty-like consistency. It was moderately movable and appeared to be anterior to the fundus uteri and the right broad ligament.

Preoperative diagnosis.—1. Ovarian tumor, right.

2. Retroversion flexion and displacement of the uterus.

3. Chronic pelvic inflammation with adhesions.

Operative procedure.—The patient was prepared for the operation, and the following morning, under spinal anesthesia, a laparotomy was done. Upon inspection the following conditions were revealed: There was a large orange sized tumor of the right ovary which was cystic and fairly thin walled. It was situated anterolateral to the uterus and it extended downward separating the layers of the broad ligament to the level of the cervix. The uterus appeared normal in size, but was pushed downward and to the left in moderate retroversion flexion. The sigmoid colon was densely adherent to the posterior aspect of the uterus and cyst, obliterating the cul-de-sac. Both tubes were tortuous, slightly distended with fluid, and closed at the fimbriated ends. There were two small bluish nodules on the surface of the left ovary; and the ovary was cystic, about the size of a golf ball. There was another bluish nodule of the uterine body upon the vesical reflection of the peritoneum. The tumor was dissected with difficulty by sharp dissection from the closely adherent intestine; and during this process, the cyst ruptured, spilling some thick chocolate-colored fluid. The base was clamped, the tumor excised, and the pedicle ligated. Upon further dissection downward of the tenaceous adhesions, it was found that the intestine was very closely adherent to the posterior uterine wall and the right leaf of the broad ligament and a pocket was opened along this line of cleavage which exuded about a teaspoonful of chocolate fluid such as was found in the right ovarian cyst. A small rent was made in the musculature of the sigmoid colon in separating the dense adhesions, which was repaired with a continuous suture of intestinal catgut. A small amount of thin gray fluid exuded from the end of the right salpinx. Due to the extensive tenaceous adhesions, the scattered endometrial implants, and the raw edges necessarily exposed in dissection, as well as to the potentialities of the primary lesion, it was decided to do a hysterectomy, including salpinges and left ovary. A supravaginal hysterectomy was done and all raw areas peritonealized. The patient was returned to her room in good condition.

Pathological diagnosis.—1. Endometriosis of the uterine wall (adenomyosis and adjacent tissue; mesosalpinx, right ovary, and intestine, with chocolate cyst of the right ovary and another cyst between the uterus and sigmoid colon.

2. Extensive pelvic adhesions.

3. Chronic salpingitis.

4. Follicular cysts of the left ovary.

Postoperative course.—The patient made an uneventful recovery and was discharged on the fifteenth day. Her convalescence was rapid and 3 months after operation (January 2, 1939), she reported to the dispensary. At that time her appetite was excellent and she had no gaseous distension nor constipation, and had gained 4½ pounds.

MEDICAL AND SURGICAL DEVICES

AN EMERGENCY KIT FOR USE BY MEDICAL DEPARTMENTS IN SHIPS

By Commander O. B. Morrison, Jr., Medical Corps, United States Navy

During present day naval engagements, ships are subjected to attack not only by submarines and surface craft, but by aircraft as well. When operating close to shore bases the bombardment from the air may last for a number of hours. We must expect and be prepared to treat rapidly large numbers of personnel casualties. We can expect to have only a small number of hospital corpsmen and must therefore see to it that each and every member of this ship's medical department is thoroughly trained in first-aid procedures. Exploding shells, torpedoes, and bombs will cause flash burns, fractures, and wounds. These injuries may, and likely will, occur in many parts of a ship almost simultaneously. I think all will agree that in many emergencies the hospital corpsman will have to act independently and use his own judgment as to how best he can treat the burn, stop hemorrhage, splint fractures, and prevent shock, unnecessary pain and suffering.

The primary consideration of all hands is to keep the ship fighting with maximum effectiveness. One of the elementary things that everyone is taught in ships of our Navy is that it is vitally important that the ship's watertight integrity be maintained at all times during battle and certain other emergencies. The lives of all of us, and the safety of the ship as a whole, depend on how well we understand and carry out this lesson.

There may be no real lull in the battle for long periods of time, and it may be unsafe to allow water tight doors to be opened. Material damage may also block access to certain compartments and spaces, and the normally used passageways rendered impassable.

The men from the ship's crew who are assigned to assist the medical department as stretcher bearers should be carefully selected and have at least sufficient intelligence to be trained thoroughly in first-aid procedures. It would be highly desirable to have men who were sufficiently interested in this work that they would volunteer for this duty. The instructions issued by the Bureau of Medicine and Surgery, and by fleet and force medical officers, in regard to the training of all members of the crew in first-aid treatment in emergencies

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is specific and important. These instructions should be most carefully and conscientiously carried out. This means hours of hard work, demonstration after demonstration, drill after drill, at all kinds of hours and in varying conditions. It, above all, requires an infinite amount of patience and understanding. Even with all this, the results obtained will often be disappointing. The experiences of those who have actually had to cope with modern naval casualties should keep us from placing too much dependence on help from this source. In the heat of battle there will always be some who become hysterical, confused, or forgetful of the training they have received.

The regularly established dressing stations may be demolished or rendered unfit for use. We must be prepared to set up an emergency dressing station in a number of different parts of the ship.

In view of the above discussion it seems logical that we should plan to treat most, if not all, casualties where they occur. It has been stressed by many other medical officers that those whose injuries are such that they can go back to the job of fighting should be given priority in treatment. Other more seriously injured cases will, of necessity, have to be treated by the shipmate who is temporarily free from his regular duties or wait until the trained first-aid men and medical department personnel can give him assistance. Only first-aid emergency treatment should be attempted in most cases. To accomplish this with speed and efficiency an adequate supply of surgical dressings and materials should be instantly available to treat burns and wounds and to relieve pain and shock.

The new emergency kit will give the corpsmen serving with the repair parties or the fire and rescue parties a fairly adequate supply of dressings and equipment. He will be able to easily carry the required supplies to any part of the ship wherever battle casualties or accidents have occurred (fig. 1). These supplies will be available instantly. The kit is designed to be normally carried on a person's back so that both hands and arms are free to climb up or down ladders or crawl through manholes or along decks and narrow passageways. He will be able to go to the machine-gun or searchlight platforms or slide along a twisted and warped deck. Fully loaded, the kit weighs only about 25 pounds. At the top of the kit there is a lifting handle or loop which can be used for suspending the kit from any convenient projection. The top of the kit is of the flap design with snap fasteners. The entire front panel flap can be dropped down by means of a zipper on each side. On the outside of the side walls there are pockets and straps for carrying 12 basswood splints. In the interior there are 7 shelflike pockets. On the front of each pocket a list of the contents is stenciled for quickly

FIGURE 1.—SHOWING EASY METHOD OF CARRYING EMERGENCY KIT.

FIGURE 2.—SHOWING CONTENTS OF EMERGENCY KIT.

locating the required items. (See fig. 2.) The time required to manufacture this model was about 1 hour. It is made of light canvas No. 12. Khaki-colored canvas could be used, or it could be painted any color desired. The measurements are as follows:

	Inches		Inches
Length	24	Width of front flap	15
Breadth	18	Side pockets for basswood splints	5 by 5
Depth	6		
Width of straps	2	Side strap for basswood splints, width	1
Length of straps	32		
Depth of pockets for materials	5	Length of zippers	18
Length of front flap	18		

The contents can be varied to meet the requirements of the individual medical officer. Hemostatic clamps are provided in individual, sterile covers so that in cases where it has been necessary to apply a tourniquet, the "bleeders" can be clamped and tourniquets removed as soon as possible. A suggested list of supplies that can be easily transported in this kit is as follows:

20 large battle dressings.
24 small battle dressings.
10 tubes of tannic acid jelly.
6 rolls of 1-inch bandage.
10 rolls of 2-inch bandage.
4 triangular bandages.
2 2-inch rolls of adhesive tape.
1 note book.
1 lead pencil.
1 flashlight.
1 pocket knife.
1 package, diagnostic tags.
8 rubber tourniquets.
1 bottle alcohol, denatured.
1 bottle Scott's solution.

1 pocket case, complete.
15 packages, morphine syrettes (5 syrettes in package).
10 tubes silk suture with needle attached.
4 tubes catgut plain "0" for ligatures.
1 bottle adrenalin.
1 bottle coramine or caffeine sodium benzoate.
2 sterile 2 cc. syringes with needles.
8 sterile hemostats in individual packages.

It has been suggested by one of the force surgeons that the kit could be used as a "battalion aid bag" for landing forces. An oil silk or other light waterproof slip cover could be slipped over the entire bag if used during surf landing operations.

The author wishes to express his appreciation for the work by D. H. Pfaffly, boatswain's mate, second class, in connection with manufacture of this emergency kit.

PREPARATION OF PROCAINE-EPINEPHRINE SOLUTIONS FOR USE IN DENTISTRY

By Lieutenant Commander George N. Crosland, Dental Corps, United States Navy

This article is directed to those who have frequently been concerned with the great amount of time consumed in preparing fresh sterile procaine-epinephrine solutions in the dental surgery. In those cases

where its use is occasional, but is wanted quickly, the porcelain boiling cup technic has been slower than we have desired. A method of preparation is described that has proven to be simple, safe, and rapid. It requires no equipment that is not on the medical supply table. This technic is not original or new, but is not generally used in the dental activities of the Navy.

A 10 cc. ampule of triple distilled water (stock No. 1–300) is nicked at the neck with a file. The ampule is flamed at the scratch and then the top is gently tapped off with a metal instrument. The lip of the open ampule is flamed. Next, the bottle of procaine-epinephrine tablets is opened and the mouth of the bottle is likewise flamed. The desired number of procaine tablets are placed in the water in one of two ways, as may be preferred by the operator. The tablets may be shaken into the ampule of water directly from the bottle, or a pair of cotton pliers can be flamed and the tablets picked one by one from the bottle and dropped into the water. Following the placing of the procaine in the water, the ampule is held over the flame for a few seconds to aid in the dissolving of the tablets. (Do not allow the water to get hot.) The solution is then ready for use.

This technic can be accomplished in 60 seconds or less. For those who require freshly prepared procaine-epinephrine solutions in their dental surgery, this technic is of definite value.

EMERGENCY FIELD OPERATING TABLE FOR RECTAL AND PERINEAL SURGERY

By Lieutenant, junior grade, L. C. Day, Medical Corps, United States Navy

The "set-up" is relatively simple. A board 30 by 2 by 1 inch, was set on edge just beneath the table top and next to the legs of the end of the table and strapped to each leg. Another board 26 by 4 by 1 inch was set on edge across the lower part of the end of the table and next to the legs so that this edge rested on the lower leg braces. The board was then strapped in this position. The purpose of these two braces was to support the crutches. The adjustable crutches were placed vertical and lateral to the table top and strapped to the boards and the legs (see fig. 1) so that the crutches served as knee crutches while the patient was lying on the table. The adjustability of the crutches enhanced the adjustability of the device. Foot straps were made out of muslin which were supported by the head part of the crutches. The muslin was approximately 30 by 6 inches and the ends were sewn together after insertion through the head part of the crutch. This formed loops for the support of the feet during the operation. Since a spinal anesthetic was used it was necessary to

FIGURE 1.—SHOWING CONSTRUCTION OF EMERGENCY TABLE.

place blocks about 4 inches in height under both of the legs at the end of the table in order to keep the patient's head lowered after the anesthetic was administered. The head part of the crutches was padded well to facilitate adequate circulation of the patient's legs. Trial positions tried by a hospital corpsman before the operation convinced us that such a device was quite comfortable and afforded adequate exposure. This was proven to be true later when the patient was operated on. No difficulties were encountered either during or after the operation. The operation was done because of prolapsed external hemorrhoids, which, due to the severe pain that the patient had, kept the patient from working. This condition did not yield to previous palliative treatment.

The photograph was taken by Lt. Comdr. R. A. Rose, chief engineer aboard this ship, and full credit is due him for the excellent photograph taken.

LOW PRESSURE CHAMBER INSTALLED AT THE NAVAL AIR STATION, PENSACOLA, FLORIDA

By Lieutenant Commander T. D. Boaz, Medical Corps, United States Navy

A low-pressure chamber has been installed at the Naval Air Station, Pensacola, Fla., and functions as an activity of the Medical Department. The chamber is used for indoctrination of flying personnel in the effects of anoxia and the proper methods of preventing them. All student aviators are given runs in the chamber at various simulated altitudes, both with and without extra oxygen. These indoctrination runs are preceded by lectures on the design, operation, maintenance of existing (Navy issue) types of oxygen supply apparatus and on the basic physiology of respiration.

The need for oxygen indoctrination for the aviator has very definitely arisen because of the marked increase in altitudes at which our more modern airplanes are flying. During the last war, and for a period thereafter, aviators were instructed in the effects of anoxia by use of the rebreather apparatus. However, the knowledge obtained from this method of indoctrination was quite limited and the procedure slow because only one subject could be employed at a time. It was decided, therefore, to equip the aviation training bases with low-pressure chambers, in the hope that the instruction will definitely fix the importance of oxygen equipment in the mind of the aviator. Further instruction in the use of extra oxygen and equipment will be given the aviator later, when he becomes attached to a combat squadron. This advanced instruction is under the supervision of the flight surgeon and squadron oxygen officer.

The chamber, which is cylindrical in shape, is 20 feet long, 8 feet in diameter, and is divided into 2 compartments; the larger is 16 feet long, containing 14 seats (7 along each side), and the smaller or lock compartment being merely 4 feet long and containing 2 seats on each side. The 2 compartments may be operated separately when the door between them is secured. This is of importance for individuals who become distressed during a simulated high-altitude run. They may be transferred to the lock compartment and brought quickly to atmospheric pressure while the others remain at the simulated high altitude and complete the "flight." Each seat is fitted with oxygen supply equipment.

The chamber is fitted, both inside and out, with various instruments, including aircraft thermometers, stop clocks, altimeters, and rate of climb indicators. Mercury manometers are connected with each compartment and are calibrated to give an accurate reading of the simulated altitude inside. Communication between the inside occupants and the two outside observers is maintained by means of a three-way speaker system.

During June 1941 a 2-weeks course of instruction in oxygen work and in the operation and maintenance of the low-pressure chamber was given by the Medical Department, Naval Air Station, Pensacola, for personnel from the naval air stations at Jacksonville, Miami, and Corpus Christi. Each of these stations sent two flight surgeons and two enlisted men. These officers and men are now operating the oxygen indoctrinational units at their respective stations.

At present, all student aviators are required to take the oxygen indoctrinational instruction. Later, it is contemplated to include qualified aviators and flight order enlisted men. In addition, all student flight surgeons from the School of Aviation Medicine are given several hours instruction in this work.

The results and interest shown by the first 1,000 trainees taking the prescribed training have fully demonstrated the value of the low-pressure chamber. They have experienced anoxia, know its insidious effect, and have learned to trust their oxygen supply equipment to relieve them of symptoms due to insufficient oxygen.

A SIMPLE TEST FOR JAUNDICE[1]

By Lieutenant Commander Julian Love, Medical Corps, United States Navy, and Pharmacist's Mate, first class, A. R. Leake, United States Navy

The diagnosis of the presence of jaundice is, as a rule, a relatively easy one. The yellowish discoloration of the skin, sclerae, and mucous

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[1] This paper was presented at the fourth meeting of the Midway Islands Medico-Dental Society, September 6, 1941.
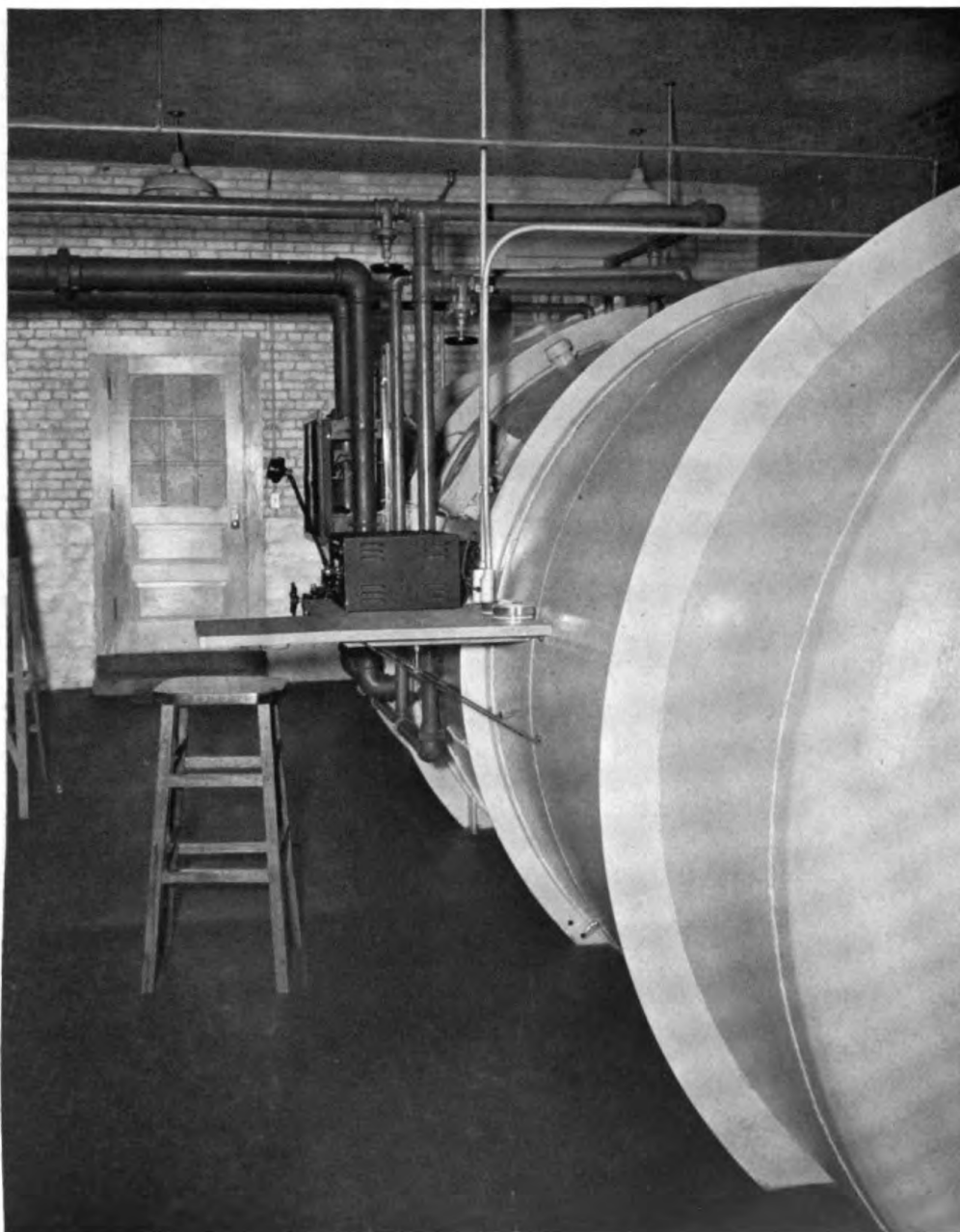
FIGURE 1.—OUTSIDE VIEW OF LOW PRESSURE CHAMBER SHOWING MAIN
COMMUNICATION STATION AND CONTROLS.

membranes is usually evident on clinical inspection. There are, however, many patients who exhibit jaundice in a subclinical level, and the physical appearance, while somewhat suggestive, is not conclusive, and resort is made to certain laboratory tests in the blood and urine. Not only in these cases, but also in those with clinically evident jaundice, the discerning physician prefers to corroborate his findings with some laboratory method. To the above-mentioned groups, which may be diagnostically confusing at times as a result of carotinemia and the staining effects of atabrin used in the prophylaxis and treatment of malaria and *Giardia lamblia* infestations, should be added malingerers who are utilizing picric acid to simulate jaundice. A simple means of proving or disproving yellowish discolorations of the skin being due to bile pigments should be of value to draft boards or others engaged in activities in which malingering may frequently be met.

While there are many good and reliable tests for bile pigment, it is felt that none is quite so simple as the Smith iodine overlay contact ring test. The technic is simple, for all one needs to do is to overlay the suspected fluid in a test tube with a small quantity of 0.7 percent tincture of iodine (ordinary tincture of iodine diluted to one-tenth strength with alcohol); if bile pigments are the cause of the discoloration, a very distinct green ring will form at the junction of the two solutions.

The use of this test in urine, particularly in patients with simple hepatitis or catarrhal jaundice, is fairly common, but we have seen no reference to its employment in the serum of such cases. The same green ring is formed, however, when dilute iodine is overlaid upon serum obtained from these patients. As a further check, this test was employed on normal serum, normal serum plus carotene, normal serum plus atabrin, and normal serum plus picric acid. In none of these was there any evidence of a green ring at the junction of the serum and 0.7 percent alcoholic iodine solution.

To the medical officer in isolated stations and in the field where equipment is limited, this test is very practical and easy to do, for tincture of iodine is always available, whereas materials required for the van den Bergh and other tests for bile pigment may not so readily be at hand. Even nitric acid required for the well-known Gmelin test is not always available. In the management of patients presenting a yellowish discoloration, if the cause of such discoloration proved not to be due to bile pigments in the serum or urine, then the clinician armed with this fact should be able to force the patient to admit which of the other means was employed, or at least be able to gain this knowledge from the history.

In a negative sense this test may sometimes be of value where acholic stools or duodenal contents are suspected, for failure of the

green contact ring to appear when the dilute iodine solution is over-laid would prove the absence of biliary pigments where normally they are present.

CONCLUSIONS

1. The technic and simplicity of application of the iodine overlay contact ring test for the presence of bile pigments has been presented.

2. The use of this test (Smith test) in testing urine and blood serum to prove the presence of jaundice has been explained. Its value in disproving jaundice in patients with yellowish discolorations due to carotinemia, atabrin staining, and malingering by ingestion of picric acid has been demonstrated.

3. The value of a negative Smith test in patients with acholic stools and duodenal contents has been suggested.

4. The use of this test is recommended, therefore, in cases of sus-pected jaundice, particularly for those physicians who are stationed on duty where other means and methods are not so readily available, or wherever a rapid and simple method is desired.

A NEW CELLOPHANE DRESSING

By Lieutenant Commander J. W. Kimbrough, Medical Corps, United States Navy

While cellophane has been used as a postoperative dressing a rather thorough search of the literature has failed to reveal any record of its having been used as herein described.

Any wound involving a loss of tissue is subjected to repeated trauma by the change of dressings. The newly formed epithelial or connective tissue cells are quite delicate and tend to become macerated if the dressing is soaked off, or if a wet or greasy dressing is used. While true of all wounds, these conditions are of special importance in industrial surgery where the dressing, in addition to becoming rapidly soiled, is frequently saturated with grease or oil. In re-moving these substances, additional trauma is encountered as a certain amount of scrubbing is necessary.

In addition to this mechanical tearing away of newly formed cells, the wound is opened to infection with each dressing. That this is not intended by nature is seen in the rapidity with which such areas become covered by a scab or crust, the result of which, aside from the mechanical protection offered, is to keep the secretion from the wound in contact with the area where the repair process is occurring. This point assumes added importance when we remember that such secretions, aside from a nutritive function for the new cells, have been found to contain bacteriostatic substances. Advantage is taken of this fact in the treatment of burns with tannic acid, the use of

Unna's paste dressings in the treatment of ulcers, and the application of adhesive strips to the edges of healing wounds where new epithelium is forming.

Cellophane is composed of cellulose and is obtained from wood pulp or cotton linters. It possesses numerous advantages as a surgical dressing since it can be autoclaved, preferably between layers of gauze, without damage, and, in addition, is transparent, tough, and flexible. Ultra violet rays penetrate it readily and can thus be utilized in treating chronic lesions without the necessity of removing the dressing with the resultant exposure of the wound to infection. Being impervious to water the patient can bathe without the necessity of protecting or removing the dressing. Cellophane is resistant to all the commonly encountered chemicals, and is not acted upon by such solvents as ether, alcohol, carbon tetrachloride, gasoline, acetone, or carbon bisulphide. There is no tendency for this substance to adhere to a denuded area and it can be removed at any time with no pain or difficulty. This, however, is rarely necessary as the wound can, at all times, be inspected for healing or infection due to the transparency of the dressing.

· The resistance of cellophane to the more common solvents at first proved a handicap, as some such substance was sought for adhesive purposes. Since none of these sufficed, it was finally decided, after much experimentation, to use the adhesive material from ordinary adhesive tape. For this purpose about 3 inches of a 1-inch adhesive strip is loosely folded and placed in the bottom of a medicine glass. Over this is poured approximately 5 cubic centimeters of ether. With the end of an applicator this is thoroughly mashed down into the ether and stirred around for a few moments until the adhesive material has left the tape. The latter is then discarded, and the whitish solution spread, by means of a tightly wound applicator, over the surface of the cellophane to be applied next the wound. After the ether has evaporated from the glass, the adhesive substance left in the bottom can be again made ready for use by the addition of more ether, with stirring. In the more detailed description of technic this ether solution will be referred to as the adhesive substance. It is not desirable to have this solution too thick, as can easily be the case due to evaporation. This is prevented by the addition of more ether as needed. The adhesive substance is also applied to the skin edges about the wound.

In describing the application of this dressing in further detail, it will be assumed that sterile technic is used throughout. The cellophane may be obtained from any one of numerous sources (wrappings, purchased in sheets, etc.). A piece is cut out sufficiently larger than the wound to allow for adhesive purposes. The corners

are clipped as these tend to loosen first. A plain clamp is barely secured to one edge, and the cellophane and clamp placed in alcohol for a few minutes. The wound is cleaned only with alcohol and ether, no medication being applied. A piece of sterile gauze is now placed on the table, and the cellophane, by means of the clamp, placed on this. Another piece of sterile gauze is put into position above this in such a manner that the cellophane patch can be blotted dry. The top piece of gauze is removed carefully as the patch may be sticking to it, the clamp having been removed during the drying process. To the cellophane, which is lying flat on one of the pieces of gauze, the adhesive substance is evenly applied with a tightly wound applicator, care being taken to see that the edges are properly coated. As this material dries practically as fast as it is applied thin areas may be gone over at once. During this application the patch is secured, if necessary, by again applying the hemostat to the edge. By this means, also, the cellophane, which is opaque, is transferred to the wound, properly arranged to entirely cover the area, and gently smoothed into place. If necessitated by the contour of the part to be dressed, the edges of the dressing are crimped to insure close adherence to the surface. Upon being firmly applied the patch at once becomes perfectly transparent.

The preceding is a description of the method of choice in applying the dressing in most cases. Two other methods may be used, however. In one, the edges of the cellophane patch are secured by adhesive strips; and in the other, the patch is secured by a piece of adhesive in which a window is cut. The latter method is frequently of use in a location subjected to much friction, as on the dorsum of the foot where the shoe rubs.

Since the description of the technic of applying the dressing has been given it will be evident that its small size and thinness add to its desirability. There is no bulky dressing to prevent the wearing of a shoe or glove, and it does not interfere with the operation of a complicated or dirty machine.

The dressing has been of special value in wounds involving a loss of substance necessitating clot formation preliminary to healing, and in chronic ulcers. In the case of burns, the result obtained is very much the same as with the use of tannic acid, a much shorter time being involved in the application. Although this dressing is not intended as a substitute for tannic acid it should be remembered that the latter substance destroys the superficial layer of cells by its action, thus further increasing the damage. Also the tannic acid method of treatment is not indicated in small burns and here the cellophane works nicely.

FIGURE 1.—ILLUSTRATING TYPES OF CELLOPHANE DRESSINGS.

Accurate controls have been impossible, as no two areas are wounded to exactly the same extent and burns at different locations are subjected to a varying amount of irritation, as caused by pressure from clothes, movement near a joint, and other factors. However, as nearly as could be judged, the lesions treated by the cellophane method have seemed to heal in from 1 to 5 days less time than similar wounds treated with other dressings. Scar tissue is certainly reduced to a minimum and fewer dressings are needed, resulting in a saving of both time and dressing material. Furthermore, pain due to stiff and adherent dressings is controlled at once, and all our patients have been very enthusiastic about this method.

So far, 2 weeks is the longest period that one dressing has been left in place. At the end of this time, the cellophane is as firmly adherent as when first applied, unless mechanical loosening has occurred. From the cases so far treated, it would seem that the length of time required for healing is the only determining factor in how long to leave the dressing in place. In order to minimize the mechanical loosening mentioned above, a thin piece of gauze is generally placed over the patch for the purpose of preventing friction from clothing and other objects.

Where a profuse discharge is present, as from a chronic ulcer, the dressing will be lifted at its weakest point and the secretion thus escaping will reseal the patch by drying at the edge when the pressure has been relieved. There is no tendency for the entire patch to loosen in such cases. Such lesions are now dressed by placing the edge of the patch nearer the edge of the ulcer at the location where it is most desirable for the secretion to escape. It is striking how quickly even a moist surface will dry and heal under the cellophane patch, and in no case has any maceration of the area been noted.

Following the observation that no infections had occurred with this dressing, cultures were made of the secretion in two cases. For this purpose, two patients were selected who had the most chronic and extensively ulcerated lesions, it being assumed that these would most likely be infected. Cultures taken under aseptic conditions revealed staphylococci in both cases. However, both these lesions were healing nicely and no sign of infection was noted at any time. This would seem to indicate that the bacteriostatic substances present in the secretion are able to keep in check any ordinary infection present, if given the opportunity to remain in contact with the wound.

NOTES AND COMMENTS

LESSONS IN NAVAL MEDICINE FROM MODERN NAVAL WARFARE

In the present World War, in progress since September 1939, or for more than 2½ years, naval medical men have had abundant opportunity to obtain a large amount of valuable experience in actual naval operations and naval combat. One of the most important lessons in naval medicine which have been learned, is the necessity for dispersion of medical personnel and medical material about the ship so that injury from an enemy's action will not destroy the entire medical personnel or material of the vessel. In other words, do not "put all your eggs in one basket." This results in the necessity of having small medical units in various parts of the ship, and also storage place for dressings, drugs, and instruments in a number of places.

Another interesting development which parallels the experiences of the first World War is that burns constitute a large percentage of the wounds. With this, too, antiflash clothing has been shown to be of value in limiting burns. In this connection it may be stated that any clothing is, in a sense, an antiflash measure; and that long-sleeved clothing should always be worn in action. Shorts or other type of clothing which leaves the extremities bared are extremely dangerous. Even a very thin film of clothing is enough to protect from flash burns in most instances.

Another interesting lesson is the necessity for intensification of first-aid instruction of everyone in a military service. This has long been recognized in our Navy and indeed in other navies. In both the first and present World Wars the value of having every officer and man thoroughly trained in first aid has been demonstrated time and again.

Among other developments is the necessity of having water in small containers scattered about the ship. In battle, water lines are frequently interrupted and it is essential that the wounded and indeed the working personnel are not deprived of water. Disruption of electric circuits make flashlights and hand lanterns a necessity. These should be carried by all medical department personnel and secured to them by a lanyard as the concussion of exploding bombs or shells may throw men about and objects carried in the hands are lost.

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In connection with the treatment of burns, one of the problems which has been encountered by naval medical officers everywhere is the removal of fuel oil from wounds and the skin. It often happens that a wounded man be covered with fuel oil and has a burn in addition. The most satisfactory all-around removal measure at present has proved to be ordinary soap and water. Research to find a better solvent for oils on an injured body surface is needed. In the dressing of burns a solution or a liquid preparation into which dressings can be dipped and applied is the most simple and practicable. Sterile-salt solution, or tannic-acid solution are examples, or mineral oil to which some of the sulfonamide drugs have been added can be used. Jellies which have to be smeared on are less quickly applied. Another lesson of this war is the tremendous value of dried plasma or human albumin in the treatment of hemorrhage and burns.

The necessity for the use of morphine in large quantities in dealing with battle or disaster casualties makes a rapid and easy method of administration an important matter. The use of the individual syringe or syrette has proved of great value and large numbers must be available. Dosage of one-half grain is almost standard for the initial injection. The placing of a morphine tablet or tablets under the tongue must not be forgotten. The sublingual mucous membrane under the anterior portion of the tongue, absorbs water soluble drugs so rapidly that this method is an alternative to hypodermic injection.

Among other lessons from war experience are the necessity for medical personnel being well supplied with gas masks. These are needed not necessarily to combat poisonous gases used in chemical warfare, but for entering compartments filled with smoke or gases from exploding shells or bombs for the purpose of rescuing wounded.

THE IMPORTANCE OF PLASMA PROTEIN REPLACEMENT IN SEVERE BURNS

Within the past year or two, there has been a growing realization of the importance of plasma loss in burns and the application of this principle to the treatment of severely burned patients in that large amounts of plasma protein must be injected in order to achieve a beneficial therapeutic effect.

"Of the 5,000 deaths each year in the United States attributed to the effects of severe burns, many could undoubtedly be avoided by adequate replacement therapy in this serious type of injury," says Elman in the January 18 A. M. A. Journal, in his article on *The Therapeutic Significance of Plasma Protein Replacement in Severe Burns.* In all the recent work in the treatment of severe burns, the importance of protein loss is stressed, and the urgency of

replacing this loss is necessary if the severely burnt patient is to be saved. The protein loss affects not only tissue protein but also plasma protein, and it can be replaced by plasma transfusion. The use of a therapeutic fluid without colloid properties fails to relieve the hemoconcentration, because of its rapid escape from the vascular bed.

The magnitude of this replacement therapy designed to meet the plasma loss is not generally realized. Elman points out in his same article that in one of his cases it was necessary to give 20 cc. of blood per kilogram of body weight to a child, and had to be repeated each day for 4 days. This would correspond in an adult, to transfusions totaling 5,500 cc. of whole blood. Anything less would probably not have replaced the large amount of plasma protein.

As a substitute for plasma protein, acacia has been used because of its colloidal properties. Acacia, however, although superior to dextrose or saline solutions, is a foreign substance and if given in large amounts may be taken up by the liver and may interfere with hepatic function.

In severe burns, the importance of a high protein diet is most important and the possibility of the injection of amino acids into the blood stream awaits clinical trial as a further line of therapy.

THE UNITED STATES NAVAL MEDICAL SCHOOL

One of the most interesting units of the group forming the National Naval Medical Center is the Naval Medical School. Officially established in 1902, its forerunners were the old Naval Laboratory established in Brooklyn in 1853, and perhaps also the school for medical officers founded and operated by Dr. Thomas Harris in Philadelphia in 1822. It now has an unbroken record of 40 years of continuous operation. The principal function of the school and its historical position are scarcely appreciated by even many of the members of the Medical Corps, itself. It might be well, therefore, to state what might be considered the five great functions of the Naval Medical School.

1. It is the center of postgraduate education in the Navy.

2. It is the only postgraduate school in the country in which the important specialty of naval medicine is taught.

3. It is a great consulting medical center for the entire Navy.

4. It is a research center in both general and naval medicine.

5. Finally, its library is the principal collection of books and pamphlets on the subject of nautical medicine in the New World.

One feature in the history of the Naval Medical School which should receive wider recognition is the part which it played in the development of tropical medicine in the United States. The necessity for increased knowledge of tropical medicine followed the Span-

ish American War and our acquisition of numerous tropical depend-encies. The Medical Corps of the Army, and of the Navy, both became leaders in the specialty of tropical medicine in the United States. Both Services produced a number of men who became eminent in the specialty and from the period of about 1905 to 1930, the Naval Medical School was the leading center for instruction in tropical medicine in this country. Many of our leading medical schools have since developed important departments of tropical medi-cine but the Naval Medical School must always be regarded as hav-ing been the pioneer center for knowledge of tropical medicine in this country for nearly a quarter of a century.

It is now being planned that the function of the school as a research center will be taken over by a regular research unit to be known as the Naval Medical Research Laboratory. This will form a separate unit of the National Naval Medical Center which will then consist of the Naval Hospital, the Naval Medical School, the Naval Dental School, and the Naval Medical Research Laboratory.

A CONSIDERATION OF SOME FACTORS INVOLVED IN TESTS OF PHYSICAL FITNESS

The subject of physical fitness of naval personnel has not lacked discussion, and considerable attention has been directed recently to the formulation of a suitable exercise program. There are, however, many difficulties attendant to an estimate of physical condition, and for this reason an objective evaluation of results from such an exercise program has been impossible up to the present.

Height and weight tables serve as an approximate index to the general condition of a given individual, but the limitations of these criteria are manifold. For example, many athletes have been passed over in recruiting because of nonconformance with the standard table.

Similarly, the Schneider Index, although a useful tool in many cases, possesses limitations which make it a far from infallible guide in the determination of cardiovascular efficiency.

Various tests of muscle dynamics are perhaps useful under certain conditions but it has been shown repeatedly that the influence of reflex training is very important and complicates any conclusions that might be drawn as regards general physical condition. Thus, it is possible for an average individual who has been trained on a hand ergometer to better by far the first attempt on this instrument by a superbly trained football player.

At present, Lieutenant Commander A. R. Behnke (MC), U. S. N., Ensign N. Pace, H-V (S), U. S. N. R., and co-workers are attempting to find a more quantitative basis for the measurement of physical fit-

ness. One of the most promising methods to date is a determination of the specific gravity of the entire individual. According to data thus far obtained by Lieutenant W. Welham (MC), U. S. N., the value for specific gravity allows an estimate of the relative fat content of various individuals and, as a corollary, their general physical condition. Thus, a group of professional football players exhibited consistently higher specific gravities than an average group of naval men in spite of a considerably higher weight average for the former group.

A step-up test similar to the Schneider test but which eliminates several undesirable features of the latter has also been developed at this laboratory.

An important factor in maintaining the best physical condition, and which is usually neglected, is a diet designed to aid in removing excess fat, since excess fat is an obstacle to attaining the best physical condition. The so-called training table in athletics is as indispensable as is the physical training of these men, yet no such rigid dietary regimen is extant in naval work. An experimental program along these lines is in operation at present in which nutrition studies are being conducted both from chemical and physiological approaches.

The factor of diet cannot be emphasized too strongly in any attempt at physical training. It will bear reiteration that if stored fat consumed in exercise is immediately replaced by overeating very little is gained by exercise.

There is a need for a more objective appraisal of physical fitness and more rigid dietary supervision in the naval service. These are difficulties which must be overcome if the personnel are to be brought to and kept at the peak of physical conditioning that is mandatory in successful military operations.

ARTICLES OF SPECIAL MERIT, 1941

The Surgeon General takes this opportunity to express to all contributors to this bulletin, his satisfaction with the excellence of their articles and his appreciation of their support of the Bureau's publication.

It has become an established practice for the Surgeon General to present letters of appreciation to authors who have contributed articles of outstanding merit to the Naval Medical Bulletin. For the calendar year 1941, the following officers have received letters of appreciation:

Commander A. H. Yando (DC), U. S. N., and Lt. Carl A. Schlack (DC), U. S. N.: Oral Cysts of Dental Origin. January 1941.

Lt. Comdr. Arthur M. Master(MC), U. S. N. R.: Treatment of Cardiovascular Emergencies. April 1941.

Comdr. L. R. Newhouser (MC), U. S. N., and Capt. Douglas B. Kendrick (MC), U. S. Army: Human Plasma and Serum. October 1941.

Capt. J. C. Adams (MC), U. S. N.: Psychiatry in Aviation. October 1941.

AIR CONDITIONING AND BACTERIA CONTROL OF OPERATING ROOMS

In Hospital Management for July 1941, L. J. Mamer makes several observations on bacteria content and air conditioning in operating rooms.

He draws attention to many unsolved problems. Temperature, humidity, filtering, number of changes per hour, and other features are still debatable. A temperature range of 80°–85°, with a relative humidity of 50 to 65 percent is considered best for the patient, while a temperature range of 70°–76° with relative humidity of 40 to 55 percent is considered the best range for the comfort of the operating personnel. Some hospitals use the conditions best for the patients, while others use that which is best for the workers, believing that the patient can be covered more warmly to compensate for the lower temperature, while he gains by the more efficient work of the operating personnel.

It was formerly believed that a high relative humidity would eliminate the danger of anesthetic explosions. This is now known to be untrue, for a serious explosion has occurred with a relative humidity of 65. Gases in the air, such as carbon dioxide in certain percentage, may greatly reduce the danger of explosions. Further tests are now being conducted along this line.

Ultraviolet radiation has shown great promise in reducing the number of bacteria in the operation field. Several types of lamps have been recommended for the purpose, but only one, the mercury vapor lamp, gives off more ultraviolet radiation than heat. It is the only one that gives the greater part of its radiation in the established wave length of 2,537 angstroms, which is the most efficient wave length for destroying bacteria. Not all mercury-vapor lamps give off the same type of radiation. It is necessary to have one with the correct vapor, and highly efficient filtration by the container. Therefore it is important to deal with a reputable manufacturer.

Isolation of the observation group behind glass is important, for the bacteria count rises very rapidly when such a group enters the operating room, even though wearing sterile caps and gowns.

The writer concludes that unsterile air is an important source of wound contamination, and that it can be practically eliminated by the use of ultraviolet radiation; that excluding everyone from the operating room except the operating personnel is a sure way of

keeping the bacterial count low; that the installation of an air-conditioning system is a distinct aid in purifying the air. It also increases the comfort and efficiency of the operating personnel.

NEW MEMBERS, AMERICAN COLLEGE OF SURGEONS

The following-named naval medical officers were nominated by the Bureau of Medicine and Surgery for fellowship in the American College of Surgeons, and the Bureau has been informed that they were elected at the 1941 convocation of the college.

Lt. Comdr. Thomas M. Arrasmith, Jr. (MC), U. S. N.
Lt. Comdr. Courtney G. Clegg (MC), U. S. N.
Lt. Comdr. French R. Moore (MC), U. S. N.
Lt. Comdr. Robert C. Boyden (MC), U. S. N.
Lt. Comdr. Freeman C. Harris (MC), U. S. N.
Lt. Comdr. Armand J. Pereyra (MC), U. S. N.

NEW MEMBERS, AMERICAN COLLEGE OF PHYSICIANS

The Bureau of Medicine and Surgery has been informed that the following naval medical officers have been elected to membership in the American College of Physicians:

FELLOWSHIP
Commander George B. Dowling (MC), U. S. N.
Lt. Edward P. McLarney (MC), U. S. N.

ASSOCIATESHIP
Commander Vincent Hernandez (MC), U. S. N.
Lt. Comdr. Leon D. Carson (MC), U. S. N.
Lt. Comdr. Cecil L. Andrews (MC), U. S. N.
Lt. Jerome F. Smith (MC), U. S. N.

ADVANCES IN MEDICINE AND THE MEDICAL SCIENCES DURING THE YEAR 1941

The following is a brief résumé or calendar of the more recent advances in the clinical branches of medicine, as well as in the medical sciences. An attempt has been made to confine it to discoveries or important advances that were made during the past year, though this has not always been possible as some of the work extends several years back and has only become recognized during 1941. Furthermore, it is, naturally, not possible in so brief a compass as a few pages to mention but the most outstanding achievements. With work so recent, too, it is difficult to appraise with absolute accuracy that which will stand the test of future experience.

NAVAL MEDICINE

1. The oustanding feature of naval, and, indeed, of all military medicine is the extensive and successful use of the sulfonamides in wounds. War experience indicates that sulfanilamide powder placed in the wounds exercises a profound effect in preventing infections. Its use in all types of wounds in the peritoneal cavity and in wounds of the brain is one of the most outstanding and revolutionary contributions to military medicine. In addition to the local use, one of the sulfonamides, preferably sulfadiazine, is recommended to be used by mouth to still further prevent the occurrence of infection.

2. The official adoption by the United States Navy of vaccination against:

   (a) Tetanus.
   (b) Yellow fever.

3. Air embolism as a disease of both divers and airplane pilots was established largely by medical officers of our Army and Navy during 1940 and 1941. In other words, the caisson disease of divers is present in pilots or others where distinct and rapid changes of barometric pressure occur in their environment.

4. The use of mass miniature x-ray of the chest by which all recruits are examined for the presence of tuberculosis was officially recognized and adopted by our Navy.

5. The setting up in all navy yards and naval industrial plants of industrial hygiene units headed by a specialist in this field. This important step in the prevention of industrial diseases and accidents is almost entirely a development of 1941 in the United States Navy.

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6. The creation of mobile base hospitals with portable buildings in sections, readily packed up and transported to distant or overseas stations and there quickly established. This is a feature developed in the United States Navy during 1940 and 1941.

7. The recognition of burns as the predominant type of wound on capital ships particularly, and the value of clothing as an antiflash protection against burns in action. This is the result of the experience of all navies during the war.

8. The recognition of the necessity for the dispersion of medical stations, medical material, and medical personnel in various parts of the ship so that the entire medical facilities are not destroyed by a single hit.

MEDICINE

1. The outstanding feature of medicine is the continual advance in the use of new sulfonamide drugs. Of these, 1941 has shown particularly the development and employment of sulfathiazole and sulfadiazine.

2. First visualization of the influenza virus was reported by Chambers and Henle of the University of Pennsylvania using the electron microscope.

3. The isolation of penicillin and other bactericidal substances from the penicillium molds was the work of Fleming (St. Mary's Hospital, London) and Glister and Florey (University of Oxford).

SURGERY

1. An important surgical development is the use of plasma in surgery for intravenous injection in place of ordinary blood transfusions. Its value in shock and particularly in the treatment of burns makes its use a measure of greatest importance in military surgery. Not only plasma, but the blood albumin, dried and then redissolved, is being used. Research work is being continued with the purpose of making available bovine or other animal blood plasma, perhaps in crystalline form, to take the place of human plasma and human albumin.

2. In surgery, as in the field of internal medicine, the use of the sulfonamides both in wounds and administered internally in surgical infections, such as ruptured appendix, is one of the major developments of the year. While surgeons are not all in agreement on the merits of this new treatment, there is no doubt as to its value in many surgical situations. In England it has been used extensively in wounds involving the brain and nervous system with great success and in compound fractures. The experience both from casualties in battle, air raids, and industrial accidents has been considerable. In the field of ophthalmology, too, in wounds of the eyes it has proved useful.

3. Vitamin C in the treatment of wounds. Evidence that this vitamin is necessary in the healing of wounds has existed for a long time. A characteristic feature of scurvy was the reopening of old wounds. Hartzell and Stone, of Wayne University College of Medicine, have demonstrated that the strength of the tissue in healed wounds is dependent on vitamin C as at least one factor, and that such tissue is five times stronger in animals with an adequate supply of the vitamin than in those deprived of it.

4. Vinyl resin, a plastic, dissolved in acetone has been used at Tulane University as an antiseptic to paint the skin. It is claimed that it is bactericidal, protects the skin, is elastic, transparent, cuts easily, and does not irritate. It is sprayed or painted on the skin to which it adheres well. One disadvantage in military surgery is the inflammability of the solvent (acetone).

5. The very extensive adoption of cotton thread in surgery both for sutures and ligatures. It is considered less irritating to the tissues than most other sutures.

6. The isolation, identification, and synthesis of a coumarin compound from sweet clover which causes a hemorrhagic disease in rabbits is of signal importance. The chemical produces the disease in experimental animals and is now being tested to see if it will prevent thrombosis and embolus formation in human beings, especially following surgical operations. The substances affects the prothrombin mechanism of animals and man and appears to be something of an antagonist of vitamin K (Campbell, Smith, Roberts, and Link).

TROPICAL MEDICINE

1. There was described for the first time a disease discovered in the Western Province of Uganda, to be known as Bwamba fever, characterized by sudden onset, fever, headache, and backache. It lasts from 5 to 7 days and is nonfatal and occurs in regions from 2,300 to 2,500 feet in altitude. They also designated the causative agent as a filterable virus which was specifically neutralized by convalescent serum and which produced a fatal outcome when injected into mice (Smithburn, Mahaffy, and Paul, Amer. Jour. Trop. Med., 21:75—1941).

2. During 1941, strong clinical evidence was accumulated indicating that atebrin was of greatest value in the treatment of giardiasis. Lamblia infestation does not seem always to produce clinical symptoms, but there is evidence that it does so at times. Atebrin is the first drug in which the use of it produces a marked diminution in the number of lambia in the individual case and disappearance of the clinical symptoms.

PREVENTIVE MEDICINE

1. Formation of mobile epidemiological laboratories and teams for the study of disease conditions and prevention was introduced by the Medical Department of the United States Navy.

2. Demonstration that the virus of sleeping sickness from the North Dakota and Minnesota area is transmitted by a *Culicine* mosquito, and that an intermediate reservoir of the virus exists in the prairie chicken and probably other wild animal hosts, was made by United States Public Health Service workers.

3. A survey of general health conditions in the United States during 1941 shows that in spite of war conditions in many parts of the world and the large numbers of people brought together in the United States due to the application of the selective service draft and the development of war industries there were no serious epidemics of the major communicable diseases. The only increase over the previous year was in measles, and this was mostly in younger children. The only other change was an increase in industrial and motor vehicle accidents.

4. The results of 15 year's experience with immunization programs against Rocky Mountain spotted fever were reported. The results indicate that the vaccine produces a certain degree of immunization but that it is not complete. The protection does not last longer than 1 year; however, if one is infected during the year the symptoms are ameliorated.

5. During the year 1941 our knowledge of histoplasmosis was extended and it is now clearly evident that this fungus disease is widespread through the Temperate and Tropical Zones and that it has been confused with several other entities. The fungus was grown on the chorio-allantoic membrane of developing chicks, contributing another chapter to its peculiarities (Moore, Amer. Jour. Trop. Med. 21 : 627—1941).

OBSTETRICS AND GYNECOLOGY

1. The year 1941 saw no marked changes in diagnosis and treatment in this field. Perhaps the most notable thing, as in several other specialties, was the increased use of the sulfonamide drugs. They were of distinct value in certain types of puerperal infections.

2. In the last 2 years there has been a sharp increase in the birth rate in the United States. It is expected that it will reach 18.5 per thousand in 1941 in contrast to 17.3 per thousand in 1939. There has also been a decrease in the maternal death rate, which it is expected will reach a new low in the United States in 1941. It is predicted that it will be less than 4 per thousand, a remarkable improvement within the past decade; for in 1931 the rate was near 7 per thousand.

3. The development and acceptance of the synthetic female sex hormone stilbestrol practically indentical with the natural hormone occurred during 1941.

4. An early clinical test for pregnancy by the determination of histidine in the urine has been extensively tried in the Scandinavian countries with excellent results. It is known as the Regine Kapeller-Adler method. While the percentage of errors is greater than in the biological tests, it is simpler, and may be used as a preliminary test or as a corroborating test to physical examination. Biological tests such as the Aschheim-Zondek and the Friedmann-Schneider or other biological tests are used only in case of doubt. The histidine test is not reliable in the presence of gestational toxicosis.

RADIOLOGY

New developments looking toward the use of three dimensional or stereographic fluoroscopy and x-ray are among the features of 1941 in this field. While not yet fully practicable it is not too much to hope that the near future may see stereographic plates and fluoroscopy as the usual routine of x-ray departments.

ANATOMY

Colored moving pictures in the dissection of the various parts of the body have been brought to a high state of perfection and are proving of great value in the teaching of general and surgical anatomy.

PHYSIOLOGY

1. An interesting development of the year has been the recording on phonograph records of heart sounds both normal and those heard in the various heart lesions.

2. Work which showed that the reversible reactions of enzymes was effected by pressure and could be changed at will by variations of pressure won the annual thousand-dollar prize of the American Association for the Advancement of Science. This research was carried out by F. H. Johnson of Princeton University, and D. E. S. Brown and D. A. Marsland of New York University.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,
  UNITED STATES NAVAL MEDICAL BULLETIN,
    Bureau of Medicine and Surgery, Navy Department,
      Washington, D. C.
                              (For review)

A SHORT HISTORY OF NAUTICAL MEDICINE, by *Louis H. Roddis, M. D., Captain, Medical Corps, United States Navy.* 359 pages with 12 illustrations. Paul B. Hoeber, Inc., New York, publishers, 1941. Price $3.

This story has all the fine historical touches combined with a wealth of factual material so arranged that it makes up a highly readable book both from the standpoint of entertainment and information. The author is a well-known American medical historian whose pages reveal a tremendous amount of historical research between the lines together with a nice choice of matter to sustain the interest of the reader and an ability to condense many ideas into few words.

Nautical medicine has developed step by step with man's conquest of the sea. Mastery on, under, and over the water has been followed closely by progress in the medical fields which have to do with the health, comfort, and safety of the sea travelers. The practice of quarantine by the Romans was among the first of these advances. The transition from oar-propelled to sailing vessels heralded the recognition, prevention, and treatment of scurvy, typhus, and smallpox. With the development of better combat technics came more competent surgery and better facilities for the care of the expanding personnel. Similarly, the submarine and aircraft have brought other medical problems — man's adjustment to rapid change in his physical environment.

Without pedantry or lengthy discussion, Captain Roddis sketches the medical phases of nautical expansion. He undertakes in 360 pages an Homeric version of seagoing medicine, from the trireme era to modern times. Although such a condensation necessarily must be far fom complete, he enables one to cove a field heetofore obtainable only by wide and selective reading.

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His technic of presentation reveals the painstaking research pre-requisite to all condensed writing. The story of cholera is told by a graphic excerpt from the medical log of the U. S. S. *Ossipee*. Trotter's "Medicina Nautica" is the background for the discussion of the sailor and venereal diseases. Nautical hazards are presented and as an example of these there is related Victor Hugo's tale of a gun rampant, in his novel "Ninety Three." Through the words of Sir Walter Raleigh, Sir Richard Hawkins, and Midshipman Jack Easy the rise of naval hygiene is vividly illustrated.

Almost one-third of the volume is a history of medicine in the United States Navy. Chapters on "Hospitals for Seamen and Hospital Ships" and "Nautical Medicine and the Merchant Marine" give a different type of historical exposition than is usual. There is a succinct summary of the natural history of the uniform of the medical corps, some of it presented with considerable humor, as well as a prophetic chapter on the history-to-come of nautical medicine. The latter completes the picture of the expanding role of medicine in naval affairs by defining problems for a future Lind, Trotter, or Barton. To insure, if such be necessary, such research Captain Roddis lists 35 promising subjects covering the entire gamut from seasickness to naval history and suggests the award of "the Cutbush Prize" as a further impetus.

Progress in nautical medicine is inevitable. Fortunately for those who go down to the sea in ships, Longinus, Jenner, Cutbush, and scores of others needed no prize competition to stimulate their efforts—nor do their medical heirs. There is need, however, of lucid, smoothly written histories of their accomplishments which make attractive reading for the layman—medical and nautical. "A Short History of Nautical Medicine" is one of the first of these—the first by an American author—and the Medical Corps of the Navy should be proud of this fact. Subsequent editions would be improved by a glossary of sea terms, and an index should also be included. There is a chronology of important events in naval medicine and a bibliographical note.

The book is appropriately bound in navy blue with gold lettering and the type is perhaps as fine as can be found in America. This volume should be of particular interest at a time when so many of the medical men in the country are serving with the Medical Corps of the Navy, as it portrays the background and development of naval medicine. It would form a useful indoctrination manual for young medical officers.

OPERATIVE SURGERY, Including Anesthesia, Pre and Postoperative Treatment, Principles of Surgical Technic, Blood Transfusion, and Abdominal Surgery, edited by *Frederic W. Bancroft, A. B., M. D., F. A. C. S., Associate Clinical Professor of Surgery, Columbia University.* D. Appleton—Century Co., New York, publishers, 1941. Price $10.

This is a thorough, modern volume on the operative surgery of the abdomen written by 34 outstanding authorities. Over 300 pages are devoted to anesthesia, preoperative and postoperative therapy, blood transfusion and surgical technic. The section on anesthesia is quite complete and considers the later methods of intravenous and rectal anesthesia as well as the older inhalation, regional and spinal anesthesias. Although the technic of continuous spinal anesthesia is omitted, a fair modern evaluation of the various anesthetic methods is presented. Especially valuable are the sections on blood transfusion and preoperative and postoperative therapy. Such timely subjects as vitamin K, heparin, and the blood substitutes are discussed in nice detail. The use of bone marrow transfusions and infusions are not included.

The various chapters on abdominal surgical technic and surgical operations are complete, comprehensive and authoritative. Present day masters of surgery have described in detail the various abdominal operations and have included the rare as well as the common procedures. The sections on total gastrectomy, the surgery of the colon and the rectum, and the surgery of the spleen are especially complete and comprehensive. The use of such newer agents as the Miller-Abbott tube, sulfanilamide crystals in the infected peritoneum and abdominal parietes, and of the gastroscope are well described.

Section and chapter arrangements are well thought out and the illustrations are profuse but of rather poorer quality than would be expected in a volume of this high quality. The book is well bound in full cloth, and the printing and paper used are of good quality.

INFANT NUTRITION. A Textbook of Infant Feeding for Students and Practitioners of Medicine, by *Williams McKim Marriott, B. S., M. D., Late Professor of Pediatrics, Washington University School of Medicine; Physician in Chief, St. Louis Children's Hospital, St. Louis.* Revised by *P. C. Jeans, A. B., M. D., Professor of Pediatrics, College of Medicine, State University of Iowa, Iowa City.* Third edition, 475 pages, illustrated. The C. V. Mosby Co., St. Louis, Mo., publishers, 1941. Price $5.50.

The third edition of this book is another important contribution by the author to infant nutrition. It has been the author's purpose to assimilate all practical facts bearing on infant nutrition and to

present them to the practitioner and student in such a way as to make them more useful. The author points out that there are numerous ways in which infants may be fed successfully, and that there is no one method of feeding which is to be recommended to the exclusion of others. On the other hand, there is no reason to resort to complicated formulas or expensive proprietary preparations when the particular requirements of the individual case may be fully met by simpler means. He stresses the simpler means in this book and states any complications of feeding method is not only unnecessary but introduces greater chances of error.

The first chapter describes the normal feeding and growth of an infant, as the author stresses the point that one must know the normal before he can treat the abnormal infant. Gastrointestinal diseases of infants, such as vomiting, diarrhea, and constipation have received much importance. The relationship of infection to nutrition has been given a separate chapter as the author thinks this condition so important that disturbances of infants which are previously attributed to dietary faults are in reality results of infections. Subjects, such as anhydremia, acidosis and alkalosis, rickets, and tetany have been given special consideration. The book is divided into 32 chapters and is well illustrated. The type of print and paper make it easily readable. The book is well indexed and contains many charts and tables. The last chapter describes miscellaneous technics such as collecting urine, the making of urine and stool cultures, collecting blood, blood groupings, and blood transfusions. He describes intraperitoneal injection, continuous intravenous injection and gavage. There is also an outline suitable as a guide for recording the medical history of infants. The last page contains a dosage table for infants for 6 months and 1 year. For the student and the general practitioner and those interested in infant nutrition, this book is recommended.

ROENTGEN TECHNIQUE, by *Clyde McNeill, M. D., Louisville.* Second edition, 329 pages, illustrated. Charles C. Thomas, Springfield, Ill., publishers, 1941. Price $5.

The student, radiographer and roentgenologist alike will find that this book presents a comprehensive description of the essentials of correct positioning in radiography in a concise, practical, and simple manner. The illustrations and roentgen anatomical drawings are adequate and of good quality. The book is well bound, well printed, and of convenient size.

PATHOLOGY FOR STUDENTS AND PRACTITIONERS OF DENTISTRY, by *William E. Ehrich,*
M. D., Associate in Pathology, School of Medicine, University of Pennsylvania.
509 pages, illustrated with 234 engravings. Lea and Febiger, Philadelphia,
Pa., publishers, 1941. Price $5.50.

This excellent textbook of pathology should be a welcome and
valuable addition to the library of all dentists. As the author states
in his preface, "This text is to be regarded as an attempt to present
the subject as a part of general pathology. Therefore the material is
arranged according to such fundamental principles as heredity, in-
fection and inflammation instead of following in an anatomical order,
the structures of the mouth."

The reviewer is of the opinion that this text covers the subject
matter exceptionally well. The entire volume, which is of conven-
tional size, consists of 509 pages of well printed and clearly presented
subject matter. An excellent bibliography follows each of the 14
chapters. The text is well illustrated containing many fine and well
selected illustrations in black and white. In addition to a complete
and accurate index, the author has included an author's index.

CANCER OF THE FACE AND MOUTH, Diagnosis, Treatment, Surgical Repair, by
Vilray P. Blair, M. D., Sherwood Moore, M. D., and *Louis T. Byars, M. D.,*
St. Louis. 599 pages, illustrated. The C. V. Mosby Co., St. Louis, Mo., pub-
lishers, 1941. Price $10.

This book of nearly 600 pages deals with the diagnosis, surgical
and radiation treatment and surgical repair of tumors of the face
and mouth. Cancer about the face is especially interesting to the
naval medical officer because of the increased incidence as a result
of exposure to sun and weather. The subject matter is clearly and
thoroughly presented and profusely illustrated by pictures of lesions
before and after treatment. One chapter gives carefully compiled
5-year, follow-up statistics of 780 cancer patients. There are over
200 pages devoted to diagrammatic sketches to illustrate surgical
procedures and plastic repair, which should be of great value.

THE NEW INTERNATIONAL CLINICS, Volume III, New Series Four, 1941, Original
Contributions: Clinics and Evaluated Reviews of Current Advances in the
Medical Arts. Edited by *George Morris Piersol, M. D., Professor of Medicine,*
Graduate School of Medicine, University of Pennsylvania, Philadelphia, Pa.,
with the collaboration of 17 prominent physicians. 300 pages. J. B. Lippin-
cott Co., Philadelphia, Pa., publishers, 1941. Price $3.

The value of this volume depends upon its short, concise presenta-
tion of recent developments in the field of general medicine, with

abundant bibliographical references. The clinical material has been prepared by members of the Faculty of Washington University School of Medicine, St. Louis, Mo., and in general is well condensed. and ably written and edited. The subject matter is widely diversified. In addition to the clinics presented there are 9 excellent original contributions by outstanding medical men. These articles develop theoretical as well as practical points in the consideration of their subjects. This book is as readable as most medical journals and is useful in the same manner. It is nicely printed on nonglare paper and is attractively bound. The illustrative material is excellent but scanty in most instances.

IMMUNITY AGAINST ANIMAL PARASITES, by *James T. Culbertson, Assistant Profcssor of Bacteriology, College of Physicians and Surgeons, Columbia University.* 274 pages. Columbia University Press, New York, publishers, 1941. Price, $3.50.

The question of immunity against animal parasites has received only a modicum of the attention given to bacterial immunity and, consequently, is a comparatively untouched field. Yet it is of great importance. Consider the advantages to be obtained from the development of a vaccination against say, amoebic dysentery or an even more widely spread condition, trichinosis. Dr. Culbertson has contributed in this book a summary of the knowledge which we have at present in regard to immunity to parasites. His work forms a point of departure for an investigator and is also a source of information of practical value to the clinician.

THE PRACTICE OF MEDICINE, by *Jonathan Campbell Meakins, M. D., LL. D., Professor of Medicine and Director of the Department of Medicine, McGill University.* Third edition, 1,430 pages with 562 illustrations, including 48 in color. The C. V. Mosby Co., St. Louis, Mo., publishers, 1940. Price $10.

That a book on the practice of medicine should go through 3 editions and a reprinting since 1936 is in itself evidence of great popularity with the medical profession. It leads to the natural inquiry as to what this popularity is due. It seems to this reviewer that there are three outstanding characteristics of Dr. Meakin's work that explain why it is a favorite with so many doctors.

1. Superior illustrations and the judicious use of color pictures.

2. A definite and useful following of outline in the case of each disease which is described under the headings of Synonyms, Etiology, Symptoms and Signs, Pathology, Course, Diagnosis, and Treatment.

3. Clarity and brevity of statement without extraneous matter.

These are the features that make this Practice a useful manual to which the busy doctor can turn for a good bird's-eye view of each disease he is being called upon to treat. By the use of this book, without too much effort, he can have recalled to his mind the principal facts about a disease and from an authoritative source. As long as these features are maintained, it seems as if this book will continue to be popular.

HERNIA, by *Alfred H. Iason, B. A., M. D., Consulting Surgeon, Long Beach Hospital and Director of Surgery, Brooklyn Hospital for the Aged.* Illustrations by *Alfred Feinberg, Instructor of Medical Illustration, Department of Pathology, College of Physicians and Surgeons, New York City.* 1,325 pages. The Blakiston Co., Philadelphia, Pa., publishers, 1941. Price $15.

This book treats in great detail of the subject of herniae of the various types with regard to historical data; anatomy; diagnosis; treatment, by prothesis, by injection, by surgery; complications before and after treatment; and the legal aspects relating to insurance and world-wide Workmen's Compensation Act. Myodynamics, fascial dynamics, kinetics, and gravimetrics are discussed. Illustrating the detail of the book, which contains over 1,300 pages of interesting reading, there is described 58 eponymic herniae, over 40 operations for direct and indirect inguinal herniae and a greater number of operations for femoral hernia. Illustrations, it seems, should be more numerous and of better quality. The appearance and binding of the book are excellent.

CEREBROSPINAL FEVER, by *Denis Brinton, D. M. (Oxon), F. R. C. P. (Lond.), Physician in charge of the Department for Nervous Diseases, St. Mary's Hospital, London.* 170 pages with 4 art plates. The Williams & Wilkins Co., Baltimore, Md., publishers, 1941. Price $3.

Much of this monograph is devoted to the historical, bacteriological, and clinical aspects of the disease but brings out nothing particularly new in these matters. The author's concept of cerebrospinal fever is that it is a nasopharyngeal disease in which the further development of septicemia and meningitis occurs in a relatively few susceptibles. The original mortality of from 70 to 90 percent has been reduced to 33 percent by serum therapy.

In England, due to overcrowding in shelters in January, February, and March of 1940, there were half as many cases as during the entire 4 years of the World War. The season (winter), the age factor (young people), and overcrowding with poor ventilation are the epidemio-

logical factors responsible for epidemics. The search for carriers is a waste of time.

Treatment with sulfonamides has reduced the mortality in 4,388 cases to 23.7 percent in civilians and to 11.3 percent in noncivilians with rates as low as 6 to 7 percent (Perry) in a series of 900 Army cases; no serum has been used.

In order of preference one may use (1) sulfapyridine, (2) sulfanilamide, and (3) sulfathiazole, the latter probably being as satisfactory as any. The concentration of the drug should be kept at from 1 to 2 mgm. per 100 cc. of spinal fluid, and well below 5 mgm. The dose for adults should be for the first 2 days, 9½ grams per 24 hours divided into equal doses every 4 hours. For the next 2 days, 6 grams, and the next 2 days, 3 grams; in all 36 to 50 grams.

The effect is striking, and if given early, may be expected to effect a relief of symptoms promptly and to result in a cure in most cases, hence the importance of an early bacteriological diagnosis of the disease. With proper diagnosis, treatment with sulfonamides and control of ventilation, the disease can be readily controlled.

DISEASES OF THE NAILS, by *V. Pardo-Castello, M. D., Assistant Professor of Dermatology and Syphilology, University of Havana,* with a foreword by *Howard Fox, M. D., Professor of Dermatology and Syphilology, New York University, Bellevue Hospital Medical College.* Second edition, 193 pages, illustrated. Charles C. Thomas, Springfield, Ill., publishers, 1941. Price $3.50.

It is not extravagent to say that all the essential information on the subject of nail diseases is condensed in this little volume of less than 200 pages. The facts are of a widely scattered nature and from widely scattered sources, but their arrangement and condensation has been so artfully done that the final product has a smooth appearance, the reading is easy and the extreme laboriousness of the compilation is well concealed.

The general practitioner has comparatively little knowledge of these diseases despite their frequency, and even the well-trained dermatologist finds difficulty in labeling each affection. This is very probably due to the paucity of literature in English on this subject.

Some 57 entities are thoroughly described and discussed under the headings of:

1. Affections peculiar to the nails.
2. Onychodystrophies.
3. Ungual manifestations of dermatoses and systemic diseases.
4. Congenital affections.

Of particular value to the naval medical officer is the discussion of the onychomycoses, especially concerning treatment. An addendum

of considerable interest and importance lists 33 occupations in which nail affections are common, with their symptoms and causes. There is also a list of poisons capable of producing nail symptoms. These are arsenic, lead, anilin, silver, mercury, thallium, and gold. The illustrations are most excellent and the book as a whole is the work of a master dermatologist.

JUVENILE DENTISTRY, by *Walter C. McBride, D. D. S., F. A. C. D., Associate Professor of Operative Dentistry and Director of the Department of Pedodontics, School of Dentistry, University of Detroit.* 414 pages, illustrated with 294 engravings. Third edition, thoroughly revised. Lea & Febiger, Philadelphia, Pa., publishers, 1941. Price $6.

This book covers every phase of children's dentistry in detail. It is written in a frank and simple manner and is well illustrated. The procedures outlined are very practical and not at all theoretical. The chapter, Morphology of Deciduous Teeth, is a welcome one to dental literature. The author's experience with and common sense reasoning in the management of children should be most helpful to all dentists.

This book is, too, recommended to any dental practitioner interested in children's dentistry. One of the main objects of the author is to explain how this specialty may be made more attractive from a remunerative standpoint.

A TEXTBOOK OF BACTERIOLOGY, by *R. W. Fairbrother, M. D., M. R. C. P., Director of the Clinical Laboratory, Manchester Royal Infirmary; Major, R. A. M. C.* Third edition, 451 pages, illustrated. The C. V. Mosby Co., St. Louis, Mo., publishers, 1941. Price $5.

This work was originally planned and written as a textbook that would present the more practical medical aspects of the subject of bacteriology for the use of medical students. It has accomplished this in a very satisfactory manner and the fact that the present edition is the third in 4 years, with one reprinting of the first edition and two of the second, is an indication of the recognition of its value.

The material is authoritative and up-to-date. It is arranged logically and in a clear, concise manner. The chapter on viruses has been rearranged in the third edition to bring it abreast of the newer accepted knowledge in this particular field.

Wounds and Fractures, A Clinical Guide to Civil and Military Practice, by
H. Winnett Orr, M. D., F. A. C. S., Lincoln, Nebr., Chief Surgeon, Nebraska
Orthopedic Hospital. 227 pages, illustrated. Charles C. Thomas, Springfield,
Ill., publishers, 1941. Price $5.

In this treatise the author describes the treatment of fractures by
skeletal traction and the fixation of pins in plaster of Paris casts.
He stresses the use of the ORR method in treating compound frac-
tures and osteomyelitis. This method of treatment was used for
gunshot fractures during the civil war in Spain by Trueta who re-
ports astonishing results which he attributes to the infrequent dress-
ings. One phase of treatment which the author fails to discuss is
the use of the sulfonamide drugs.

The text is clear and concise and the methods described have been
proven by experience.

Operative Oral Surgery, by Leo Winter, D. D. S., M. D., F. A. C. D., LL. D.,
Professor of Oral Surgery, New York University. 877 pages with 1019 illustra-
tions, including 5 in color. The C. V. Mosby Co., St. Louis, Mo., publishers,
1941. Price $10.

This book is probably the most profusely illustrated textbook of
oral surgery yet published. The author is to be congratulated upon
the number and character of the reproduced photographs and
sketches which adequately amplify and delineate the relatively sparse
written matter. It consists of 26 chapters printed in bold type, is
simply written and easily read.

The text pertaining to prognathous mandibles cites certain ad-
vantages in reference to the method of osteotomy apparently advo-
cated by the author and his co-workers. Their method of choice
seems to be division through the angle of the mandible. A question
may reasonably be raised as to whether the advantages for this type
of operation are superior to those for division of the ascending ramus
above the lingula.

"Anesthesia during oral surgery" as a part of the book represents
a contribution by E. A. Rovenstine, Professor of Anesthesia, New
York University College of Medicine. This chapter is based upon
the assumption that the patient to be anesthetized is a hospital case.
It is a well written treatise which briefly deals with anesthetic
principles and technics available for hospital practice.

Since visual portrayal has become such a popular aid in the dis-
semination of knowledge, this book with its many illustrations will
have special appeal to students and practitioners alike.

X-RAY THERAPY OF CHRONIC ARTHRITIS, by *Karl Goldhamer, M. D., Associate Roentgenologist, St. Mary's Hospital and Quincy X-ray and Radium Laboratories*, with a foreword by *Harold Swanberg, B. S., M. D., F. A. C. P., Editor, Mississippi Valley Medical Journal and the Radiologic Review*. 131 pages with 24 original illustrations by the author, 2 roentgenograms, and 4 tables. Radiologic Review Publishing Co., Quincy, Ill., publishers, 1941. Price $2.

This book presents the clinical aspects and pathology of arthritis followed by a discussion of the roentgen findings of chronic arthritis. This section is well illustrated with sketches made from x-ray plates of the various articulations showing the normal findings and the changes noted in chronic arthritis. The discussion of roentgenologic differential diagnosis is brief but comprehensive. The theory of how roentgen rays act on chronic arthritis is discussed. Considerable space is devoted to what cases should be treated by x-ray. The care with which x-rays should be handled is well presented.

Technic of treatment and the dosage in "r" units is comprehensive. From the case reports on 100 patients concluding the book, one believes that x-ray therapy definitely alleviates the pain of chronic arthritis and that it is valuable in treating bursitis and para-arthritis.

This book is written for the general practitioner and its contents are timely as more physicians should appreciate the value of x-ray therapy in treating inflammations and infections. It is not verbose. The printing is such that it is easy to read and the book is well bound in a cloth cover.

PRINCIPLES OF MICROBIOLOGY, by *Francis E. Colien, B. S., M. S., Ph. D., F. A. P. H. A., Associate Professor of Bacteriology and Preventive Medicine in The Creighton University School of Medicine;* and *Ethel J. Odegard, R. N., A. B., M. A., Instructor in Sciences Applied to Nursing, College of Saint Teresa, Winona, Minnesota.* 444 pages with 140 text illustrations and 18 color plates. The C. V. Mosby Co., St. Louis, Mo., publishers, 1941. Price $3.

The title aptly describes the contents of this splendid book. It is a well balanced and complete treatise on microbiology. The text, illustrations and color plates are both excellent. This work is well suited as a textbook for teaching students and graduate nurses.

THE PREMATURE INFANT, Its Medical and Nursing Care, by *Julius H. Hess, M. D., Professor and Head of the Department of Pediatrics, University of Illinois College of Medicine;* and *Evelyn C. Lundeen, R. N., Supervisor, Premature Infant Station, Sarah Morris Hospital, Chicago.* 309 pages with 74 illustrations. J. B. Lippincott Co., Philadelphia, publishers, 1941. Price $3.50.

This manual is the result of the collaboration of one of the outstanding pediatricians of the country with the supervising nurse of one of the largest premature infant stations in Chicago. The pio-

neer work of Dr. Hess in the care of premature infants is familiar to everyone interested in infant welfare. Doubtless no one in the United States could write with more authority concerning the problems of prematurity.

The text is concise and packed with information. The format of the book is excellent. One might wish that more detail had been accorded to the physiology of the premature infant, and possibly that less space had been devoted to routine details of nursing procedure. However, this book makes available the enormous mass of data collected by Dr. Hess and his co-workers during the 20 years that have elapsed since his first published book on prematurity. "The Premature Infant" is a valuable book.

PREECLAMPTIC AND ECLAMPTIC TOXEMIA OF PREGNANCY, by *Lewis Dexter, A. B., M. D., Research Fellow in Medicine, Harvard Medical School* and *Soma Weiss, A. B., M. D., Hersey Professor of the Theory and Practice of Physic, Harvard University*, with collaborators. 415 pages, illustrated. Little, Brown & Co., Boston, Mass., publishers, 1941. Price $5.

Dexter and Weiss have made, in this monograph, a notable and authoritative contribution to our knowledge of a most important medical subject. Few subjects have been more baffling to or more neglected by the average medical practitioner.

This excellent volume describes the experiences and interprets the findings of the authors in an exhaustive individual study of many cases of toxemia. An analysis of the literature in the light of these studies is also presented in a clear and simplified manner. Each chapter is closed with a summary and bibliography. The chapter on treatment is especially recommended for its practicability and clarity.

The book is well designed and attractively bound. Illustrations are profuse and of high excellence. Nonglare paper and large readable type set a high standard for this type of publication. It merits a generous reception by all physicians.

SYNOPSIS OF THE PREPARATION AND AFTERCARE OF SURGICAL PATIENTS, by *Hugh C. Ilgenfritz, A. B., M. D., Instructor in Surgery, Louisiana State University School of Medicine* and *Rawley M. Penick, Jr., Ph. B., M. D., F. A. C. S., Professor of Clinical Surgery, Louisiana State University School of Medicine;* with foreword by *Urban Maes, M. D., D. Sc., F. A. C. S., Professor of Surgery and Director of the Department, Louisiana State University School of Medicine.* 532 pages, illustrated. The C. V. Mosby Co., St. Louis, Mo., publishers, 1941. Price $5.

Many medical students and interns are prone to neglect the importance of pre- and postoperative care. It was the writer's experience

while a Resident surgeon at a large county hospital, that it was almost always necessary to stress and restress the importance of pre- and postoperative care of surgical patients as most of the interns were inclined to be more interested in the glamour of actually doing surgery than in the aftercare of these patients. Other professors of surgery have had the same experience. Therefore, there has been a demand for a book that covered the essentials of pre and postoperative care without going into lengthy detail, including only the important details. This little book meets this demand in many ways. It is of such a size that it can be carried in the pocket; it is well indexed so that any subject can be easily found. The illustrations are such that they do not require lengthy legends and are easily understood. Fluid and electrolyte balance, shock, transfusions, general preoperative and postoperative measures are the headings of the first few chapters of the book. To the embryo surgeon or to the inexperienced intern these chapters will prove of great importance. The chapters on minor postoperative and major postoperative complications, including intestinal obstructions and peritonitis, wounds and fistulas and the various complications of the systemic organs are excellent. Of notable importance are the various laboratory tests necessary before any surgery of the biliary system is done. The appendix includes the methods of treating infections with the sulfonamides, zinc peroxide, and other drugs. Various diets are included and of interest is the method of preparing patients for x-ray studies. Of equal importance are a few pages of illustrations on the correct method of administering oxygen, either by means of a tent or by the use of an intranasal catheter. This book is recommended for all senior medical students, interns, and young surgeons.

SURGICAL PRACTICE OF THE LAHEY CLINIC, Boston, Mass., by *24 contributors*. W. B. Saunders Co., Philadelphia, Pa., publishers, 1941. Price $10.

This book is made up of various papers published in the recent medical journals by members of the Lahey Clinic. It is an excellent book describing new and standard methods, technics, diagnostic procedures, and the results obtained in their surgery. The contents of the book are divided into the various body systems such as surgery of the thyroid gland, the esophagus and lungs, the breast, the stomach, duodenum and intestine, biliary tract, etc. Each author is well known in his field and is a specialist on the subject which he writes. At the end of each chapter is a bibliography and each chapter is well illustrated with half-tones, photographs, tables or drawings. The printing is easily readable and the paper is glossy. The book is well indexed, contains 897 pages, and 376 illustrations. For those

interested in surgery and the latest surgical technic, this book is recommended.

DISEASES OF WOMEN, by *Harry Sturgeon Crossen, M. D., F. A. C. S., Professor Emeritus of Clinical Gynecology* and *Robert James Crossen, A. B., M. D., Assistant Professor of Clinical Gynecology and Obstetrics, Washington University School of Medicine.* Ninth Edition, entirely revised and reset, 948 pages, 1,127 engravings, including 45 in color. The C. V. Mosby Co., St. Louis, Mo., publishers, 1941. Price $12.50.

This is the ninth edition of this book, and, therefore, the demand for another reprinting is a good indication of its worth. It is very difficult to bring the essential features of the rapid expanding gynecologic knowledge within the limits of a single textbook, but the authors have done exceedingly well in sifting the essentials and condensing the topics of importance in order to include them in one text. The authors have particularly stressed the anatomy and physiology of the female organs stating that it is necessary to understand the physiology before successful treatment of pelvic disorders can be made. The first chapter of the book is devoted to the physiology of ovulation, hormones, and the anatomy and physiology of the various organs. The second chapter is excellent in describing the correct method of making a diagnosis, the taking of a gynecological history, and the proper technic in making examination. The remaining chapters describe the various diseases of the pelvic organs, as well as the medical and surgical treatment. The printing is such that the book is easily readable. It has an excellent reference of authors and the book is well indexed.

THE NEW INTERNATIONAL CLINICS, Volume IV, New Series Four, 1941, Original Contributions: Clinics and Evaluated Reviews of Current Advances in the Medical Arts. Edited by *George Morris Piersol, M. D., Professor of Medicine, Graduate School of Medicine, University of Pennsylvania, Philadelphia, Pa.,* with the collaboration of 17 prominent physicians. 314 pages. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1941. Price $3.

This book needs no introduction to the readers and it still holds a high place among medical literature. The editor, Dr. George Piersol. and the contributors are well known in the medical field. As usual, this volume contains original contributions, clinics, and evaluated reviews of current advances in the medical arts. The book contains excellent illustrations, the print is not difficult to read, and the work is well indexed.

YEAR BOOK OF PATHOLOGY AND IMMUNOLOGY, 1941, by *Howard T. Karsner, M. D., Professor of Pathology, Director of the Institute of Pathology, Western Reserve University, Cleveland* and *Sanford B. Hooker, A. M., M. D., Professor of Immunology, Boston University School of Medicine.* 623 pages, illustrated. The Year Book Publishers, Chicago, Ill., publishers, 1941. Price $3.

As usual the 1941 Year Book of Pathology and Immunology contains the latest advances in this field. This book contains an abundance of material on the advances of pathology and immunology. It is well illustrated and well indexed.

SURGERY OF MODERN WARFARE, Volume II, by 65 contributors, edited by *Hamilton Bailey, F. R. C. S., Surgeon, Royal Northern Hospital, London.* 899 pages, illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1941. Price $10.

As was volume I an excellent book, so is volume II. This volume contains wounds of bones and joints, wounds of the face and neck, and wounds of the central nervous system and its coverings. There are two additional sections, one on surgical diseases encountered in subtropical countries and a section on administration. This includes the method of handling stretcher cases, wounds in naval action, transportation of wounded, etc. The book is especially well illustrated with both photographs and colored plates. It is of a large type of print that makes it easy reading. The book is well indexed, and is recommended to all medical officers who will have any contact with military surgery.

ESSENTIALS OF PHARMACOLOGY AND MATERIA MEDICA FOR NURSES, by *Albert J. Gilbert, M. D., Instructor of Pharmacology, Aultman School of Nursing, Canton, Ohio;* and *Selma Moody, R. N., Instructor in Nursing Arts, The Presbyterian Hospital of the City of Chicago.* 251 pages, illustrated. The C. V. Mosby Co., St. Louis, Mo., publishers, 1941. Price $2.25.

This book presents the facts and theories of Pharmacology and Materia Medica in a simple and concise form. It furnishes sound and practical material for a limited course in these subjects. The value and importance of drug standards, the Federal Drug and Harris Anti-narcotic Acts are emphasized. The dosage, action, use and untoward effect of drugs in common use is presented in a simple and comprehensive manner.

SYMPTOMS IN DIAGNOSIS, by *Jonathan Campbell Meakins, M. D., LL. D., Professor of Medicine and Director of the Department of Medicine, McGill University*. 323 pages, illustrated. Little, Brown & Co., Boston, Mass., publishers, 1941. Price $4.

The author has not attempted to write a textbook for the student or practitioner in order to help him to arrive at an immediate diagnosis, but has attempted to aid the student or practitioner, as does most every teaching professor in every medical school to analyze the importance of the symptoms that the patient presents. With the development of many laboratory technics, the student as well as most practitioners are prone to rush through the history, paying only slight attention to the symptoms in order to get the patient to the laboratory, and then depend upon the laboratory results for a diagnosis. The author states that approximately 50 percent of the patients have no signs and the diagnosis must depend upon the complaint or symptoms and therefore these symptoms are the patient's own way of telling the story.

The book is divided into five chapters, each chapter describing the normal physiological function of the anatomical systems as well as the symptoms and the various complaints that may follow a disease of these organs. The book is well illustrated, well written and the print is such that it makes it easy reading. This is not a textbook and is therefore recommended as supplementary reading for medical students learning the art of diagnosis and to the practitioner who wishes to review its signs and symptoms.

NUTRITIONAL DEFICIENCIES, Diagnosis and Treatment, by *John B. Youmans, A. B., M. S., M. D., Associate Professor of Medicine and Director of Postgraduate Instruction, Vanderbilt University Medical School, Nashville, Tenn.;* assisted by *E. White Patton, M. D.* 385 pages, 16 illustrations. J. B. Lippincott, Co., Philadelphia, Pa., publishers, 1941. Price $5.

This is a useful compendium dealing with the various known vitamin deficiencies as well as pathological conditions due to lack of certain minerals such as iodine or iron. The history, etiology, symptoms, and treatment of each condition is dealt with and there are a number of valuable tables. One of the most interesting features is an appendix giving the laboratory procedures, including the technic of the tests, of value in the diagnosis of deficiency diseases. The changing nature of the status of nutritional conditions makes any work far from definitive, but this is a good book covering the present state of knowledge of these diseases.

An Introduction to Dermatology, by *Richard L. Sutton, M. D., Sc. D., LL. D., F. R. S. (Edin.), Emeritus Professor of Dermatology, University of Kansas School of Medicine* and *Richard L. Sutton, Jr., A. M., M. D., L. R. C. P. (Edin.), Assistant Professor of Dermatology, University of Kansas School of Medicine.* 904 pages with 723 illustrations. Fourth edition. The C. V. Mosby Co., St. Louis, Mo., publishers, 1941. Price $9.

This is a contracted edition of the authors' larger work on the diseases of the skin and has all the excellent features of that work; including what is a necessity in a book on dermatology, fine illustrations.

The Modern Treatment of Syphilis, by *Joseph Earle Moore, M. D., Associate Professor of Medicine, The Johns Hopkins University;* with the collaboration of four prominent physicians. Second edition, 674 pages. Charles C. Thomas, Springfield, Ill., publishers, 1941. Price $7.

The authors of this book belong to the school of syphilology experts that believe that no matter how unsatisfactory present methods of treatment may be in many respects, and no matter how often or how rapid important changes occur in our treatment methods, it is still worth while to describe the best methods now in use and to relate the attainable results. The changes that have come into syphilotherapy since.1933 (when the first edition was issued) have indeed been numerous and profound, and thus this new edition is more justified; there is an urgent and widespread demand for it.

The first edition was quite disappointing to this reviewer in that it contained only a scant paragraph on mapharsen, although the drug had then been under extensive and intensive study for a year or more. This lack has been amply corrected in the present edition by the use of a total of some 30 pages on the subject. The Johns Hopkins experience (analyzed by Dr. Hahn) as to fatal reactions from trivalent arsenicals is somewhat similar to the frequently published navy experience. Hahn reports one death to 12,000 injections of the arsphenamines but no deaths since 1937 (among 64,000 injections, most of which were of mapharsen). The navy experience is one death to 26,000 injections of arsphenamines and no deaths among 200,000 injections of mapharsen. Moore, after 8 or 9 years' experience with mapharsen is now almost, but not quite, prepared to state that mapharsen is the drug of choice in early syphilis.

It is regrettable that the uselessness as well as the usefulness of certain drugs require so many years for public acceptance. For example, the uselessness of sodium thiosulfate in the treatment of any form of arsenical poisoning is quite well established and is pointed

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out clearly by Moore in both this and the earlier edition; yet the drug is still widely used and with insistence and with faith.

There is an excellent summary of the work done and conclusions formed as to the oral use of bismuth, particularly the recent studies of Hanzlik on sodium bismuthate. This drug would appear to be of special importance in certain navy cases where circumstances at times preclude the use of injections for periods of a few weeks. During such periods the self administration of oral bismuth could well prevent a lapse in a course of bismuth therapy.

Complete new chapters appear in this edition on the subjects of public health aspects and the intensive arsenotherapy of syphilis. The public health chapter contains much of extreme interest to the navy physician because of his concern with factors that influence the incidence of syphilis.

Publicity on the intensive therapy and so-called "five-day cure" programs has reached virtually the proportion of ballyhoo, but one great objection to such a program remains—an objection so great as to forbid the use of this method except in further experimentation. This objection is the simple but grave one of mortality. Either by the continuous drip or the multiple injection method the fatal reaction incidence is more than ten times as high as with the older conservative methods.

This book is so valuable, both because of the high authenticity and the great volume of information it contains, that no physician who undertakes to treat syphilis or who professes to be interested in its control can afford to be without it.

This reviewer unreservedly rates the book as the most valuable volume extant on the treatment of syphilis.

THE TOXEMIAS OF PREGNANCY, by *William J. Dieckmann, M. D., Associate Professor of Obstetrics and Gynecology, The University of Chicago.* 521 pages with 50 text illustrations and 3 color plates. The C. V. Mosby Co., St. Louis, Mo., publishers, 1941. Price $7.50.

This is a most interesting as well as valuable work in a field of great importance and too little explored. Medical research must cover rare and unusual conditions but the benefits of discoveries are received by the few: The discovery of the etiology and a method of cure of some condition such as Paget's disease will benefit but a few individuals; but the discovery of a ready cure for the common cold would affect every person in the world. It is this fact which makes any disease of the childbearing woman so important as it involves death or suffering to so large a number. Furthermore, as in so many obstetric conditions, the life of both mother and child are threatened.

Dr. Dieckmann discusses the latest developments in this subject which will be of value to the clinician; but not the least interesting part of this book is the stimulus it will give to the study of the physiology of pregnancy, a comparatively untouched field full of problems awaiting solution.

THE MEDICAL CLINICS OF NORTH AMERICA, November, 1941. Symposium on Military Medicine, bv 27 contributors. Volume 25, Number 6, three year cumulative index. 418 pages with 50 illustrations. Published bimonthly by W. B. Saunders Co., Philadelphia, Pa. Price per year: Cloth, $16; Paper, $12.

This issue of the Medical Clinics is devoted to a symposium on military medicine and the writers are medical officers of the Army and Navy, either regular or reserve. Some of the subjects covered are: A Physician in the Selective Service of the Army, Tuberculosis in Military Medicine, Cardiovascular Diseases in Military Medicine, Psychiatric Aspects of Military Medicine, Treatment of Shock and Burns, Disorders of the Foot in Relation to Military Service, and the Treatment of Minor War Injuries. These are by no means all of the articles, but they give an idea of the wide field which is covered. Rear Admiral McIntire, the Surgeon General of the Navy, in the foreword emphasizes the importance of military and naval medicine in the success of military operations in the following interesting analogy:

"One of the wooden frigates of Nelson's time would be an easy victim of its modern counterpart, a light cruiser of our own day. Yet, it would be no more helpless than any military force with an antiquated medical service if it were opposed to one possessed of all the knowledge and organization of the medical department of a modern army or navy."

TEXTBOOK OF GENERAL SURGERY, by *Warren H. Cole, M. D., F. A. C. S., Professor and Head of the Department of Surgery, University of Illinois College of Medicine;* and *Robert Elman, M. D., Associate Professor of Clinical Surgery, Washington University School of Medicine.* Third edition, 1,067 pages, illustrated. D. Appleton-Century Co., Inc., New York, publishers. Price $8.

This excellent work has been thoroughly revised and reset in this, the third edition. The style is clear, concise, and forceful; which adapts it admirably for teaching purposes, as well as for sustained reading. The paper and binding are of excellent quality and the type is clear and well spaced. The active collaboration of an imposing list of eminent consultants is evident as one reads the text which is

liberally supported by excellent illustrations. A bibliography is supplied at the end of each chapter so that one may extend his studies or reading.

The material is presented in a logical sequence with emphasis placed on the physiological point of view. The principles of treatment are well and thoroughly covered but the details of operative treatment have been omitted due, as they justly point out, to the fact that "most operations involve such meticulous and extensive detail that there is insufficient space in a single volume to include them in an adequate manner." From the standpoint of a navy medical officer, who so often finds himself called upon to perform operations at sea and on isolated stations with little help and no systems of surgery at hand to refer to, this omission is regrettable.   •

Due to the influence of the present war on surgical thought, the material on amputations and anesthesia has been enlarged into separate chapters and a new chapter on surgery in diabetes has been added. Well-deserved stress is laid upon infections of the hand, traumatic wounds, burns, the use of the newer chemotherapeutic agents, and the use of silk as sutures in surgery.

It is considered to be outstanding as a textbook on general surgery. It is highly recommended to students of surgery, and to general practitioners as a very modern reference work supplying briefly the latest in established surgical thought and practice.

ARTHRITIS IN MODERN PRACTICE. The Diagnosis and Management of Rheumatic and Allied Conditions, by *Otto Steinbrocker, B. S., M. D., Assistant Attending Physician and Chief, Arthritis Clinic, Bellevue Hospital, Fourth Medical Division, New York City;* and *John G. Kuhns, A. B., M. D., F. A. C. S., Chief of the Orthopedic and Surgical Service, Robert Breck Brigham Hospital.* 606 pages, illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1941. Price $8.

This book is a monograph on the subject of rheumatism in all its form, well illustrated and well documented. There is even a glossary dealing with arthritis. It has valuable tables as one differentiating the chronic disturbances of the shoulder. Both the general practitioner and the specialist can make good use of this book.

ORAL PATHOLOGY, A Histological, Roentgenological, and Clinical Study of the Disease of the Teeth, Jaws, and Mouth, by *Kurt H. Thoma, D. M. D., Professor of Oral Survey,* and *Charles A. Brackett, Professor of Oral Pathology, Harvard University.* 1,306 pages, with 1,370 illustrations, 137 in color. The C. V. Mosby Co., St. Louis, Mo., publishers, 1941. Price $15.

This is a standard work on dental pathology. The bibliography is especially voluminous, indeed it is almost a bibliography of dental

literature and is particularly useful to those desiring to consult monographs in the various fields. Another outstanding feature is the illustrations which are numerous and excellent. Many are micro-photographs and there are a number of fine colored plates.

This is the companion volume on military surgery to the Medical Clinics of North America number on military medicine. There are 12 naval medical authors and 8 from the army. Two are distinguished civilian surgeons. Containing as it does a valuable symposium of papers on the subjects connected with military surgery, it is a most timely addition to surgical literature at present. The titles of some of the articles, each by an authoritative writer, are indications of the important information made available. New Surgical Methods of Military Significance; Organization of the Navy Medical Department, Ophthalmic Surgery in the Army, Cranial Injuries in War, Management of Fractures in the Navy, Aviation Medicine, and X-Rays in Military Surgery are titles which give an idea of the scope of the information given.

THE DIVISION OF PREVENTIVE MEDICINE

Captain C. S. Stephenson, Medical Corps, United States Navy, in charge

AN ANALYSIS OF HEAD INJURIES AT THE NAVY YARD, NEW YORK, WITH REFERENCE TO PREVENTION

JANUARY 1, 1941, TO JUNE 30, 1941

By Lieutenant Commander Hyman Lieber, Medical Corps, United States Naval Reserve

Introduction.—This report presents an analysis of all cases of head injury seen at the Navy Yard Dispensary from January 1 to June 30, 1941. It was planned to serve as a basis for comparison for similar studies after the general adoption of skull guards. Special attention was given, therefore, to injuries of the skull, scalp, and forehead within the area that can be protected by safety helmets.

Frequency of head injuries.—There were 214 cases of head injury treated at the dispensary during the 6-month period. This represents a gross yearly incidence of 2.62 percent of the average industrial complement of 16,287 workers during this period.

Nineteen cases were not included in this study because the nature of the accident or the location of the injury bore no possible relation to safety helmets or skull guards.

The remaining 195 cases represent a yearly incidence of 2.4 percent of the average industrial complement. On this basis, 1 in every 42 workers had a head injury during the first 6 months of 1941.

Time-loss due to head injuries.—Ten of the cases (5.1 percent) were serious enough to require a pass-out from work. These 10 men lost 77 days, or an average of 7.7 days each. The longest period of disability was 40 days. The 10 pass-outs necessitated by head injuries accounted for 1.63 percent of the 611 tabulatable injuries from all causes during the period of observation, and the time loss they occassioned was 1.02 percent of the 7,904 working days lost because of all nonfatal accidents during the 6-month period.

TABLE I.—*Distribution of cases by occupations*

Apprentice:

Occupation		Occupation	
Boilermaker	1	Pipecoverer	1
Electrician	1	Pipe fitter	3
Ship fitter	3	Pipe-fitter helper	4
Blacksmith	1	Plumber	2
Boatbuilder	1	Puncher	1
Chipper and caulker	17	Rigger	5
Coppersmith	1	Rigger helper	5
Coppersmith helper	1	Sailmaker	1
Driller	8	Sewer	1
Electrician	12	Sheet-metal worker	10
Electrician helper	3	Ship fitter	14
General helper	4	Ship-fitter helper	20
Joiner	2	Shipwright	9
Laborer	16	Welder	7
Machinist	22	Woodworker	2
Machinist helper	3		
Painter	14	Total	195

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TABLE 2.—*Distribution of cases by shops*

Name of shop	Number of shop	Head injuries	Name of shop	Number of shop	Head injuries
Public works	00	1	Machine	38	14
Supply department	01	7	Do	39	3
Planning and estimating	03	1	Boilermaker	41	1
Ship fitter	11	10	Electrical	51	8
Drilling, chipper and caulker	12	14	Do	52	7
Ship fitter	13	13	Copper	53	2
Do	14	2	Plumbing	56	4
Do	15	11	Pipe fitter	58	1
Do	16	11	Do	59	5
Sheet metal	17	1	Shipwright	61	5
Do	18	9	Do	62	7
Forge	23	1	Painting	71	14
Welding	26	6	Rigger and laborer	72	13
Do	27	3	Do	73	3
Machine	31	2	Sail loft	76	2
Do	32	1	Laborer	79	6
Do	33	2			
Do	36	5			195

TABLE 3.—*Comparative hazard of head injuries in various trades*

	Average number employed	Head injuries	Yearly incidence
			Percent
Painters	463	14	6.04
Ship fitters	1,968	34	3.4
Laborers	919	16	3.4
Riggers	628	10	3.0
Sheet-metal workers	893	10	2.2
Electricians	1,300	15	2.2
Machinists	2,938	25	1.6
Pipe fitters	946	7	1.4
Welders	1,208	7	1.0
All industrial employees	16,287	195	2.4

Painters had almost twice as many head injuries as any other trade in the yard. It is noteworthy, however, that these injuries were not serious. Only one required a pass-out and the patient returned to work after 2 days. Shipfitters, laborers, and riggers formed the next most hazardous group, the incidence of injuries being one and a half times the average for the entire navy yard.

The nature of the accident causing the head injury was reviewed in all the cases of this series. In 92 cases (47.2 percent) "something fell"; in 84 cases (43.3 percent) the patient "bumped his head against something"; in 7 instances (3.6 percent) the injury was caused by a fall of the employee; and in the remaining 12 cases (5.9 percent) the accident was ascribed to such miscellaneous causes as "hit self with shovel," "hit by elevator gate," "hit by coupling while disconnecting air hose," "hit self with wrench that slipped," "hit by swinging chain," "hit by door blown by wind," and "hit by pipe handled by fellow worker."

Head injuries caused by falling objects are potentially much more dangerous than those due to striking the head against overhanging

structures, especially when the material falls from a considerable height. This difference, however, did not happen to be a factor in our cases. Although falling objects caused more accidents than bumping into objects, i. e., 47.2 percent compared to 43.3 percent of the total, the latter caused a loss of 44 days compared to the loss of 19 days resulting from falling material.

However, the fact that no serious or fatal accidents resulted from falling objects should be emphasized as a matter of extraordinary good fortune. One or two serious injuries would have changed the entire picture.

Prevention of head injuries.—The possibility of prevention by safety helmets was considered in each case. In 181 cases (92.8 percent) the available data indicate that the use of a safety helmet would have prevented the injury. The preventable cases included 9 of the 10 injuries that required pass-outs.

The use of safety helmets by all industrial employees during the 6-month period would have saved 76 of the 77 working days lost because of head injuries. This time-lost represented a pay loss of $407.36 for the 6-month period.

It is understood that 1,183 safety helmets have been issued to shops in the yard as of October 9, 1941, and that 3,000 additional helmets are on order. The utilizing of this safeguard is on a voluntary basis. It is believed that the wearing of safety helmets should be compulsory in occupation involving risk of head injury.

Summary.—1. There were 214 cases of head injury among the 16,287 industrial workers at this navy yard in the 6-month period from January 1 to June 30, 1941.

2. One hundred and ninety-five injuries occurred within the head area ordinarily protected by safety helmets. This represented a yearly incidence of 2.4 percent, or 1 out of every 42 men, as based on this 6-month period.

3. Ten cases required pass-outs for a total of 77 days. These 10 cases were 1.63 percent of lost-time accidents from all causes, and the time-loss represented 1.02 percent of the working days lost due to all nonfatal accidents during this period.

4. A difference in hazard existed among the 24 occupations suffering head injury. Painters had almost twice as many as any other trade in the yard. Shipfitters, laborers, and riggers formed the next most hazardous group.

5. Falling objects caused 47 percent of the injuries, and 43 percent were due to "bumping the head against an object."

6. It is concluded that the wearing of safety helmets would have prevented 92.8 percent of the injuries and 76 of the 77 days of time-loss resulting.

Recommendation.—It is recommended that consideration be given to the policy of compulsory use of safety helmets in all occupational conditions where a special risk of head injury is involved.

MERCURY POISONING FROM THE USE OF ANTIFOULING PLASTIC PAINT

By Lieutenant Commander Leonard J. Goldwater, Medical Corps, United States Naval Reserve, and Lieutenant Clark P. Jeffers, Medical Corps, United States Navy

Among recent developments in the protection of the hulls of warships against the growth of aquatic life has been the introduction of a new type of antifouling paint. This material was first used at the Navy Yard, New York, N. Y., in December 1940, although it had been in use in other yards for at least a year previously. In August 1941, following the completion of a job requiring overtime work, several men who had been engaged in applying the new antifouling paint reported to the yard dispensary complaining of various symptoms. The investigation which forms the subject of this report was undertaken in order to ascertain whether or not the symptoms were of occupational origin.

DESCRIPTION OF THE PROCESS

The new antifouling paint has as its base a synthetic resin or plastic and its active ingredients include salts of mercury, lead, and arsenic. The material is known as plastic paint, formula No. 142. It is solid at ordinary temperatures but becomes liquid upon heating. Since the plastic paint is applied by spraying, it must be heated to a temperature of about 350° F. prior to application. The solid material is first melted in a steam-heated kettle of about 300-gallon capacity. It is then transferred into a portable kerosene-heated kettle which can be run along the drydock to points of application. The hot paint is poured by buckets into a heated pressure tank from which it is delivered to the spray hose. In order that the paint may be kept in a liquid state until it reaches the nozzle of the spray gun, an electric heating element is incorporated in the spray hose. The point is referred to as "hot stuff" by the men who work with it.

SOURCES OF DANGER AND PRECAUTIONARY MEASURES

An obvious source of danger in handling the plastic paint is the possibility of burns from contact with the heated material. Several minor burns have been seen among the plastic painters but with these we are not concerned in the present report. There are two phases of the operation which are attended with danger from the point of view

of absorption of toxic fumes: (1) the preliminary heating and (2) the spraying operation itself. It seems reasonable to assume that the most important route of absorption is through the respiratory tract, and that ingestion or skin absorption play a minor role. Work with the plastic paint is intermittent in nature since ships requiring its application are not at all times present in the yard. On the other hand, occasions arise where speed makes it essential for the men spraying the plastic paint to work as long as 13 hours a day for several days. Such an occasion immediately preceded the episode described in this report.

In connection with the heating of the plastic prior to spraying, there were two points of particular interest: (1) those men who happened to be wearing gold rings while at work noticed that the gold developed a silvery coating, apparently a mercury amalgam, and (2) it was observed that when the portable heating apparatus was placed close to the hull of the ship, a silvery deposit formed on the ship's bottom in the area where fumes from the heated material came in contact with the hull. These two findings strongly suggested the presence of appreciable amounts of mercury in the fumes arising from the heated paint.

As a protective measure, each man assigned to work with the plastic paint had been given a charcoal cartridge type respirator. As is frequently the case, a certain amount of carelessness existed in the wearing of the respirators. Laxness was particularly prevalent among the men who worked around the heating kettles. This was due in part to failure of the men to realize that the fumes might be more dangerous than the actual spray.

RESULTS OF EXAMINATIONS

The first indication that the new antifouling paint might be injurious to health arose when 3 of the painters reported to the dispensary with a variety of nonspecific complaints. Among the symptoms of which these men complained were nervousness, fatigue, anorexia, constipation, and soreness of the gums. When all 3 were found to have tremors of the hands, it was considered advisable to examine all men who had been working with the plastic paint. A total of 17 men were summoned for questioning and examination. Of these, 8 had no complaints whatsoever. The symptoms of the remaining 9 are given in table 1. It can be seen that 5 men complained of fatigue and 5 of hoarseness. Constipation, anorexia, and soreness of the gums each occurred 4 times as a complaint.

TABLE 1.—*Symptoms reported by men using antifouling plastic paint*

System	Symptom	Number of cases	System	Symptom	Number of cases
Gastro-intestinal..	Constipation.......	4	Central Nervous..	Fatigue............	5
	Anorexia..........	4		Nervousness.......	3
	Nausea............	2		Headache..........	1
	Vomiting..........	1		Dizziness..........	1
Respiratory........	Hoarseness........	5	Miscellaneous.....	Skin rash.........	1
	Sore throat........	3		Swelling of face.....	1
	Tightness of chest..	1		Cloudy urine.......	1
Oral...............	Sore gums.........	4		Red urine.........	2
	Bad taste..........	2			

Abnormal physical findings were present in six cases. Most frequent was tremor of the hands (five cases) and next in frequency was gingivitis (four cases). In one case a marked edema of the face and eyelids was present. The physical findings are summarized in table 2.

TABLE 2.—*Abnormal physical findings in men using antifouling plastic paint*

Physical Finding: *Number of Cases*

    Tremor of hands_____ 5

    Gingivitis_____ 4

    Edema of face and eyelids_____ 1

    Dermatitis_____ 1

Urine specimens were obtained from the six men who seemed to be most severely affected. In none of these was albumin found, but five of the six showed the presence of occasional red blood cells. Chemical analyses were performed at the industrial hygiene laboratory of New York University College of Medicine, tests being made for mercury, lead, and arsenic. The urinary findings are given in table 3. It is apparent that abnormal amounts of mercury were found in all six cases and that in four of these the values are very high. Small amounts of arsenic and of lead were also found but the quantities were not in the range ordinarily seen in persons suffering from poisoning by either of these metals.

TABLE 3.—*Urinary findings in men using antifouling plastic paint*

Case No.	Mercury	Arsenic	Lead	Microscopic
1...	4.8	0.05	0.09	Occ. Rbc.
2...	3.2	.02	.10	Do.
3...	5.4	.03	.06	Do.
4...	2.2	.03	....	Occ. Rbc., many Wbc.
5...	.6	(1)	.06	Neg.
6...	.2	(1)	....	Occ. Rbc., many Wbc.

1 Less than 0.01.

All values are given in terms of milligrams of metal per liter of urine.

In view of the fact that appreciable amounts of mercury were known to be present in the fumes of the heated paint and in the spray, that the outstanding physical finding was tremor of the hands, and that abnormal amounts of mercury were found in the urine, it seemed reasonable to make a diagnosis of subacute or chronic mercury poisoning in those painters who had abnormal signs or symptoms. Most of the other findings might occur in almost any type of industrial heavy metal poisoning. The respiratory symptoms were probably a result of direct irritation to the respiratory tract caused by the fumes.

FOLLOW-UP EXAMINATIONS

One month after the date of original examination all the men who had had any abnormalities were recalled for questioning and re-examination. During this interval there had been very little occasion to use the plastic paint so that none of these men had additional exposure of more than a few hours duration. Most of the cases showed complete recovery with persistence of no abnormal signs or symptoms. In two cases a barely perceptible tremor of the hands was still present but, in one of these the man stated that he had always had a slight tremor. Apparently the course of the mercury poisoning in the present series of cases was similar to that usually seen in industrial mercury poisoning, namely, prompt recovery when exposure ceases.

RECOMMENDATIONS

As a result of the investigation carried out in connection with antifouling plastic paint, formula No. 142, certain recommendations have been formulated. They are as follows:

1. That the nature of the hazard be explained to all men who come in contact with the paint.

2. That all men who are to be assigned to work with plastic paint No. 142 be examined by the medical officer immediately before commencing work, at intervals of no more than 1 week while actively engaged in this work and at the completion of each particular job. The particular signs to be looked for are tremor and gingivitis.

3. That any man exhibiting signs or symptoms of mercurialism should immediately be removed from work with the plastic paint.

4. That adequate respiratory protection be provided for all men working with the plastic paint. This should be an air line respirator where practicable, otherwise a cartridge type approved for protection against toxic fumes. The cartridges should be changed at least twice daily.

5. That vigorous steps be taken to enforce the use of the respirators. If the above precautions are observed, there should be no danger in the use of plastic paint No. 142.

A TEN-YEAR STUDY OF GONORRHEA IN THE UNITED STATES NAVY

By Lieutenant Commander F. R. Lang, Medical Corps, United States Navy

Part II [1]

EPIDEMIOLOGICAL ANALYSIS OF NEW ADMISSION RATES OF VARIOUS SUBDIVISIONS OF FORCES AFLOAT

One part of the general venereal disease control program of the United States Navy is the constant and continuous indoctrination of the men in personal hygiene, sex hygiene, avoidance of exposure to venereal disease and the value and technique of chemical venereal prophylaxis. This is carried on by all medical activities having medical officers throughout the Navy. The size and scope of medical activities aboard ships in the Navy varies considerably. In the time period of this study all new recruits received the same general type of instruction in personal hygiene, sex hygiene, and the value of prophylaxis while in the Naval training stations during their first 4 months in the United States Navy. The nature and extent of continuation of this indoctrination during the remainder of the Navy man's career varied according to the size of the medical activity attached to the ship or station and according to the presence or absence of medical officers, and the actual number of medical officers.

It was considered of interest to determine whether this variation of instruction in venereal disease control might be reflected in the rates of new admissions among forces afloat. To make such a comparison it was necessary to study the rates of new cases according to types of ships. Table 5 sets forth this comparison.

For purpose of preliminary comparison, the various types of ships were divided into three major classifications. First among these are the fighting ships; these were constantly in and out of their home ports while undergoing short cruises, training problems, and tactical exercises. It is estimated that they were in their home ports about one-third of the time. Second, the auxiliary ships which were constantly

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en route and which very seldom remained in their home ports for any length of time; and third, the auxiliary ships which spent practically all of their time at anchor in their home ports.

TABLE 5.—*10-year gonorrhea study, United States Navy*

[Rates per 1,000 of the various types of ships]

Types of ships	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	10-year rate
Fighting ships:											
Battle ships	85.36	90.66	89.63	98.02	90.11	72.95	72.95	52.19	51.65	61.18	77.40
Cruisers	115.29	123.75	118.87	113.03	86.50	66.93	62.46	56.64	55.70	72.82	81.10
Destroyers	84.67	72.04	103.92	99.17	75.13	51.85	54.62	51.46	58.96	66.98	70.51
Aircraft carriers	101.59	80.08	83.46	106.36	107.28	67.04	61.12	50.91	39.63	55.71	71.18
Fleet submarines (V-boats)	37.15	30.42	52.25	35.42	37.48	22.32	10.84	12.75	14.84	18.96	23.41
Subtotal fighting ships	90.75	89.77	99.52	102.01	85.93	67.07	63.29	52.46	53.22	65.13	75.16
Auxiliary ships:											
Ammunition ships	104.29	125.44	158.27	128.21	98.98	139.78	130.00	107.14	98.69	73.33	116.79
Transports	114.27	98.30	13.36	157.44	143.46	137.96	118.88	89.57	95.60	98.69	118.03
Cargo vessels	77.95	84.91	61.61	117.24	125.00	110.32	144.65	103.66	76.92	74.89	95.06
Store ships	152.23	136.02	167.88	148.42	154.04	143.98	136.49	83.33	96.77	109.69	132.89
Oilers	133.83	111.23	116.92	131.55	112.80	86.55	87.29	116.30	89.19	85.14	106.64
Subtotal, auxiliaries constantly en route	117.57	105.30	126.68	144.30	132.65	125.81	115.53	97.09	91.52	94.34	114.56
Repair ships	77.29	62.50	73.61	75.17	56.29	80.65	62.96	35.02	38.79	50.35	43.29
Destroyer tenders	154.26	77.91	85.27	103.89	102.01	79.73	71.43	46.90	46.24	46.99	79.50
Aircraft tenders	91.11	99.25	105.78	96.64	54.55	82.69	55.19	64.10	37.07	56.48	77.81
Seaplane tenders	60.87	120.37	85.31	128.79	68.12	78.38	35.63	33.02	51.45	75.51	66.68
Hospital ship	107.69	116.22	110.28	81.08	52.36	44.08	90.23	67.71	44.01	70.53	76.47
Mine sweepers	96.09	92.74	78.73	80.27	82.32	69.92	59.12	60.88	69.08	66.99	75.97
Sub-rescue vessels	57.97	69.85	85.71	72.25	71.22	58.82	45.87	58.82	47.49	94.34	61.49
Ocean tugs	39.42	61.63	57.29	68.15	37.44	45.02	49.38	37.32	46.00	79.95	67.52
Miscellaneous	136.23	76.43	64.78	103.49	86.32	83.16	96.93	46.89	70.02	65.56	81.87
Subtotal, auxiliaries stationed at home ports	107.96	83.23	81.43	88.57	73.31	72.65	63.93	48.10	50.21	61.22	72.11
Miscellaneous ships:											
Gunboats	239.25	152.91	149.96	170.20	106.07	100.83	127.90	100.32	105.48	155.95	141.97
Mine layers	98.87	73.66	69.56	63.51	63.86	68.46	60.39	46.73	82.21	54.24	69.89
Station ships		20.00								60.00	40.00
Converted yachts	113.16	79.18	44.94	122.60	127.49	83.68	152.26	94.70	80.00	59.46	93.15
Dirigible						26.09					8.64
Eagle boats	119.27	43.86	43.86	111.11	18.18	18.87					62.12
Tender, lighter-than-air	84.51	99.38									92.41
Ships, unclassified			43.96	105.26	57.69	38.83					61.07
Subtotal, smaller miscellaneous ships	161.01	106.19	103.10	93.69	86.44	81.09	99.34	81.97	94.97	127.99	107.89
Grand total, types of ships	97.53	90.89	99.27	104.63	87.90	72.27	68.05	55.81	56.37	67.95	78.64

Graph 5 presents a comparison of the annual rates of Navy ships according to the above classification. It reveals that among these classifications the auxiliary ships which were constantly en route had the highest annual rates. Their rates are exceeded only by those of the smaller and miscellaneous ships in the years 1929 and 1936. The smaller and miscellaneous ships are a heterogenous group of assorted vessels and are so classified because they did not fall within the other major classifications. Their functions, activities, movements, and personnel were extremely variable. However, from the standpoint of this phase of the study, they do have one thing in
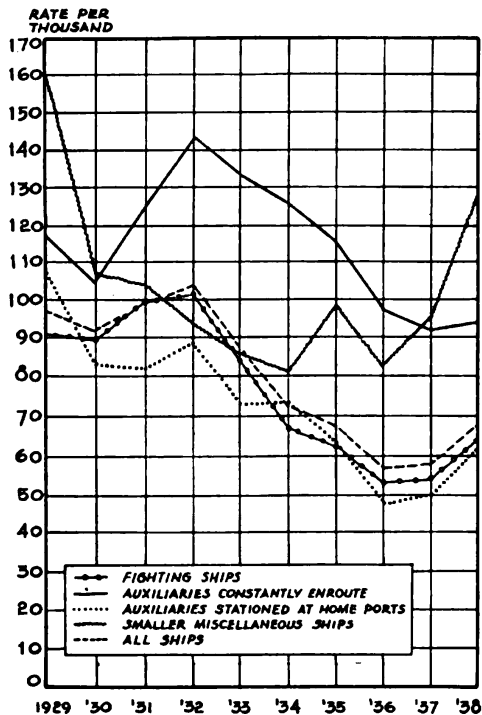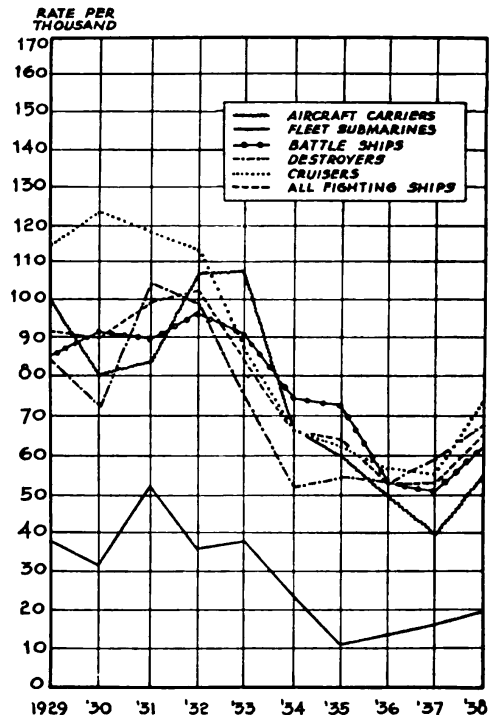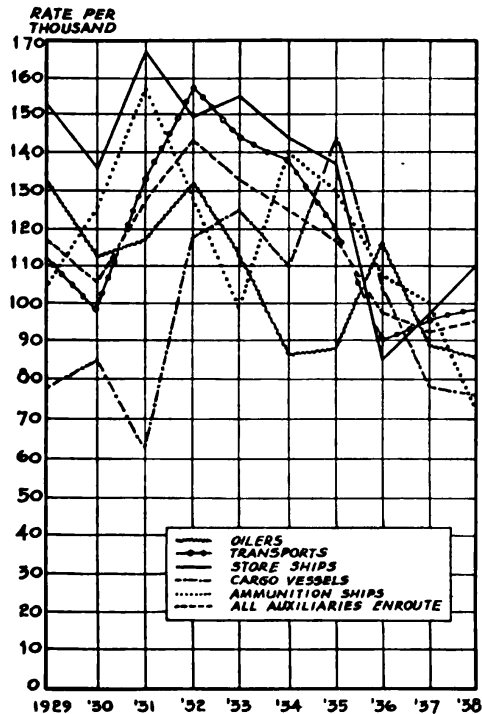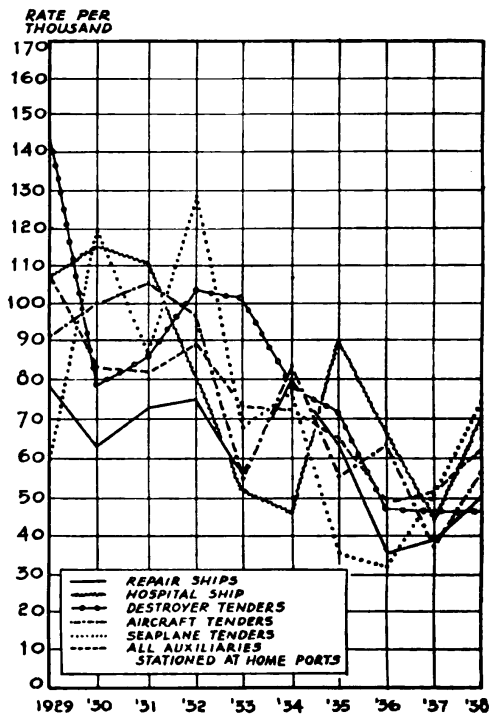
FIGURE 1.

common; in that, except for the gunboats, none of them had a medical officer attached and, therefore, their personnel received practically no continuous instruction in hygiene. Gunboats are primarily patrol vessels. They might be classed as fighting ships, but during this period they were all small shallow-draft vessels stationed on Chinese rivers. Because of the size and function of these small vessels and because local factors influencing venereal disease rates differ so much in the part of the world wherein they were stationed, it was decided not to include their incidence with those of the fighting ships.

Searching further for outstanding differences, these major subdivisions were broken down into the individual classes of ships. (Graphs 6 to 10, inclusive.)

The first disclosure of a low rate which appears unusual, is that of the fleet submarines. Repeatedly, each year these ships had the lowest rate among all types of ships. Submarines had no medical officers. Since the tenders remained in port, except during the annual maneuvers, the crews of submarines received talks on hygiene and venereal disease by a medical officer only at irregular and infrequent intervals. However, there is one factor which applies only to submarines, and which in a sense probably operated indirectly as a venereal disease control measure. Personnel on duty in submarines received a 25 percent increase in base pay owing to the added hazards of this service. Individuals for submarine service are selected with great care. Because of the cramped quarters and lack of facilities for treatment, no one having venereal disease is selected for submarine duty and crew members are inspected frequently for venereal diseases. Those who contract a venereal disease are promptly transferred from their ship. None are treated ambulatorily, hence, all lose their pay while on the sick list. It is of interest to note that only in this respect do regulations pertaining to venereal disease control differ with regard to the submarine service from the remainder of the forces afloat.

Table 5 establishes that: (1) Except for 1931, 1937, and 1939, the annual rates for the destroyers were significantly lower than the annual rates of all fighting ships combined; (2) During 1929, 1930, 1931, 1932, 1936, and 1938, the annual rates for cruisers were significantly higher than the combined rates of all fighting ships.

Airplane carriers with the largest number of doctors aboard and the best equipped medical departments had annual rates which were significantly higher in 1929, 1932, and 1933 than the combined annual rates for all fighting ships. These differences were born out by statistical tests of significance.

Table 5 shows that except for the fleet submarines, the annual rates of all these types of ships were higher than the annual rates for the entire Navy.

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Graph 9.
TEN-YEAR GONORRHEA STUDY - U.S. NAVY
Rates of Smaller Types of Auxiliary Ships
Which Are Stationed At A Home Port
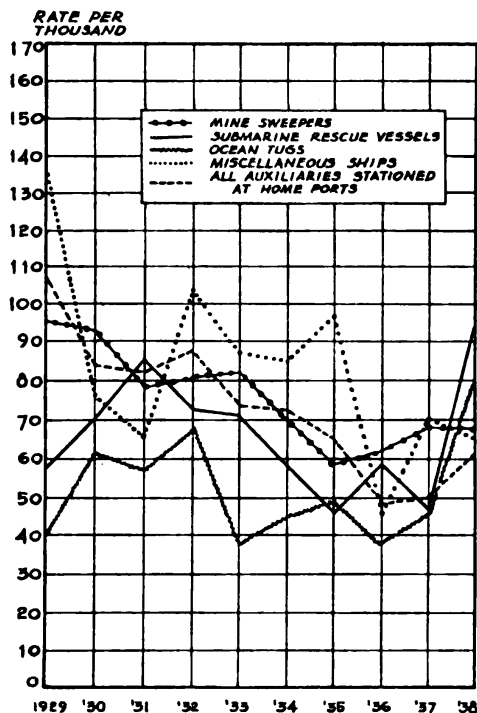
Graph 10.
TEN-YEAR GONORRHEA STUDY - U.S. NAVY
Rates of Smaller Miscellaneous
Types of Ships
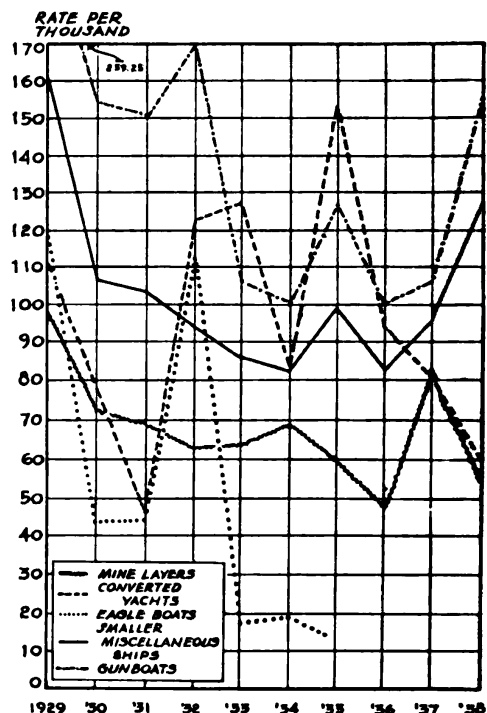
Graph 11.
TEN-YEAR GONORRHEA STUDY - U.S. NAVY
Comparison of Rates of Forces Ashore
With Rates of Entire Navy
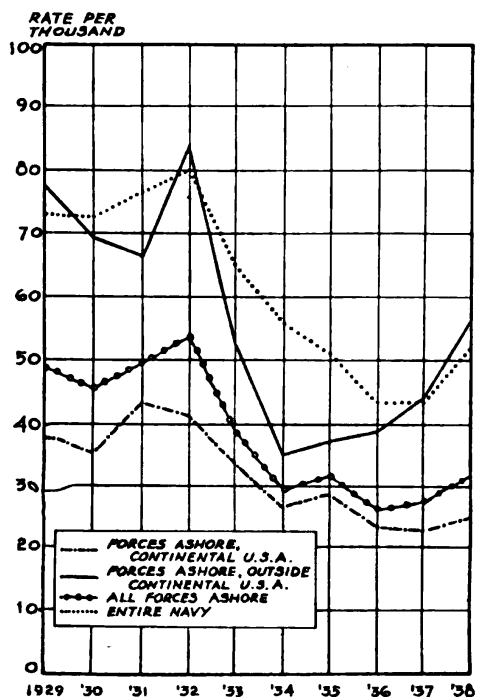
Graph 12.
TEN-YEAR GONORRHEA STUDY - U.S. NAVY
Comparison of Rates of Hospitals in the
United States with Hospitals Outside the
United States. All Naval Hospitals, and
Personnel Entire Navy
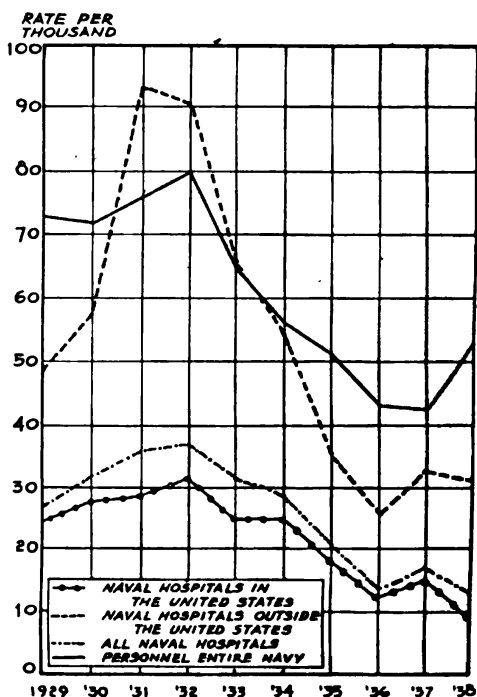
FIGURE 2.

Auxiliaries constantly under way had higher annual rates than the corresponding combined rates of all forces afloat. Also they were higher than the combined rates of the entire Navy. In this classification of auxiliary ships, the store ships had the highest annual rates. (Except in 1935 and 1936.) The annual rates of the transports were elevated in 1929, 1930, and 1936. Ammunition ships had fluctuating annual rates which on an average were high, except for the year 1933.

The annual rates of the auxiliary ships which spent most of their time in their home ports are shown on graph 8. They all show considerable variation. Graphs 7 and 8 fail to show any marked difference in rates among the types of ships in this classification. However, by comparing these two latter graphs it is evident that the group of auxiliary ships which were constantly underway had annual admission rates which were considerably and significantly greater than were those of the group which remained in their home ports for the greater part of the time.

Table 5 presents the 10-year rates for the subdivisions of this part of the study and for the various types of ships.

In summing up this part of the study it is evident that: (1) Auxiliary ships continually in transit had the highest annual admission rates; (2) auxiliary ships, which for the greater part of the period were at anchor in their home ports, had the lowest gonorrheal new admission rates; (3) the size of the medical department and the number of medical officers attached to a ship and, therefore, the amount of instruction given the crews in personal and sex hygiene and venereal disease prevention, apparently have no influence on the annual admission rates.

Of all the ships in the United States Navy, the activities, complements, medical departments, personnel, and equipment of the battleships are considered the most standardized. During the period under study all of the battleships were in the Battle Fleet, went on annual training cruises and maneuvers together, and in general put into the same ports while away from their own port, and went to the same navy yards for repairs and overhaul. None was attached to any other subdivision of the forces afloat excepting the U. S. S. *New York* and the U. S. S. *Texas* during 1937 and 1938, and the U. S. S. *Arkansas* during all of the years except 1933. These latter ships were withdrawn from the Battle Fleet and attached to the Training Detachment during the years stated.

In view of this close standardization it was believed that a study of the annual admission rates would be of value to determine if ships of similar type, size, complement, and activities had similar admission rates.

Table 6 sets forth the annual admission rates according to individual battleships for new cases of gonococcus infection of the urethra. Statistical significance tests fail to reveal any persistent or outstanding differences, which are significant and which were present consistently throughout the 10-year study period between the annual incidences of the various battleships and the expected incidences derived from the 10-year rate for all battleships (table 6a). This observation tends to confirm the obvious supposition that ships of the same type and of similar functions, locations, activities, and personnel would be expected to have similar annual admission rates.

TABLE 6.—*10-year gonorrhea study, United States Navy*

[Rate per 1,000, of individual battleships, 1929–38]

	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	10-year rate
Arizona	80.26	99.78	123.53	74.33	82.89	38.56	24.83	30.35	63.77	63.81	65.63
Arkansas					126.35						126.35
California	84.73	56.00	88.22	106.11	82.14	68.55	69.92	49.36	43.09	50.00	70.19
Colorado	73.65	136.86	118.62	120.39	118.13	78.86	80.53	42.54	49.34	82.08	91.07
Idaho	73.04	78.93	72.39	100.75	78.54	63.51	89.53	91.30	51.67	45.49	72.63
Maryland	99.18	64.39	93.53	80.30	81.56	80.90	75.77	53.27	39.05	49.13	71.62
Mississippi	57.55	67.80	97.46	58.18	77.11	70.25	72.90	38.40	43.59	58.92	62.50
Nevada	126.98	96.69	95.95	81.10	84.61	69.50	52.29	48.46	19.86	49.48	71.12
New Mexico	111.28	76.59	70.76	82.40	98.85	110.93	115.57	44.63	60.53	53.82	82.92
New York	85.27	113.95	66.06	102.91	105.76	88.50	75.57	59.49			87.59
Oklahoma	91.48	120.34	86.04	81.19	63.09	74.14	56.59	43.40	43.37	46.02	70.41
Pennsylvania	37.58	99.60	94.48	73.71	55.10	64.87	70.71	35.20	41.70	56.22	61.70
Tennessee	65.00	32.28	75.56	88.56	95.47	78.77	68.40	51.09	52.06	60.61	66.81
Texas	91.25	108.97	74.48	80.25	83.40	98.54	61.85	32.15			79.71
West Virginia	83.94	72.89	92.85	94.65	73.75	71.93	57.58	49.00	70.87	72.42	74.17
Totals	83.02	85.28	89.49	88.68	86.52	75.93	69.63	47.67	47.85	57.32	73.61

TABLE 6a.—*10-year gonorrhea study, United States Navy—chi square determinations of the individual battleships, expected incident derived from the 10-year rate of all battleships (.0736062984)*

[Degrees of significance]

	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938
Arizona	0	+	++	0	0	−−	−−	−−	0	0
Arkansas	0	0	0	0	++	0	0	0	0	0
California	0	−	+	++	0	0	0	−−	−−	−
Colorado	0	++	++	++	++	0	0	−−	−	0
Idaho	0	0	0	+	0	0	+	+	−	−−
Maryland	++	0	+	0	0	0	0	−	−−	−−
Mississippi	−	0	+	0	0	0	0	−−	−−	−
Nevada	−−	++	+	0	0	0	−	−	−−	−
New Mexico	−−	0	0	0	+	++	++	−−	0	−
New York	0	++	0	++	++	+	0	−	0	−−
Oklahoma	0	++	0	0	0	0	0	−	−−	−−
Pennsylvania	−−	+	++	0	−	0	0	−−	−−	−
Tennessee	0	−−	0	+	++	0	0	−	−	0
Texas	+	++	0	0	0	++	0	−−	0	0
West Virginia	0	0	+	+	0	−	−	−−	0	0
Total	++	++	++	++	++	0	−	−−	−−	−−

Legend:
+ Significantly higher.
++ Very significantly higher.
− Significantly lower.
−− Very significantly lower.
0 No significant difference.

EPIDEMIOLOGICAL ANALYSIS OF NEW ADMISSION RATES OF VARIOUS SUBDIVISIONS OF FORCES ASHORE

As the next phase in developing this study the forces ashore were studied. Referring both to table 4 and graph 2 it may be noted that the annual admission rates for all forces ashore for the entire Navy during this period were roughly one-half those for the forces afloat.

As the first step in the break-down of forces ashore, this group was divided into (a) forces ashore within the continental United States and (b) forces ashore outside the continental United States. The latter grouping includes forces which were ashore in our insular and territorial possessions and in certain foreign countries, notably China, Nicaragua, Haiti, and Cuba.

Graph 11 indicates that part of table 4 pertaining to the rates of the primary break-down of forces ashore. On graph 11 it is seen: (a) That, generally speaking, the forces ashore outside the continental United States had annual admission rates per 1,000 approaching one hundred percent higher than those for the forces ashore within the continental United States. (b) That in 1929, 1932, 1937, and 1938 the annual rates of the extracontinental forces ashore exceeded those for the entire Navy. (c) That the decline in rate between 1932 and 1936, observed in practically all subdivisions of this study, was more precipitous in the extracontinental forces ashore than in any other subdivision of this part of the study.

As the second step in studying the annual rates of forces ashore, these admission rates were broken down according to Naval Districts and naval activities not included in naval districts.

Of the naval activities ashore, within the continental United States, it is seen in table 7 that: (1) The Twelfth Naval District (which includes Colorado, Utah, Nevada, and northern California) in the year 1931, is the only one of this grouping of forces ashore whose annual rate exceeded that of the entire United States Navy. (2) That the activities of the Potomac and Severn Rivers and of the First Naval District, comprising Maine, New Hampshire, Vermont, Massachusetts, and Rhode Island, are the only two shore grouped activities to show annual rates consistently lower than the remainder of the forces ashore. (3) That for the remainder of the forces ashore, within the continental limits of the United States, annual admission rates did not vary consistently or significantly from each other.

Table 7 also sets forth the annual admission rates of the forces ashore outside the continental United States. The Fourteenth Naval District (Territory of Hawaii) stands out in that the rates were repeatedly and consistently lower than the annual rates of all forces ashore

within or outside the continental United States during the study period.

Table 7 sets forth the annual rates of naval activities outside the territorial limits of the United States which are not included in naval districts. One outstanding disclosure in this part of the study is the extremely low annual rate of the forces ashore on the island of Guam. Both Guam and Samoa have large native populations ranging between 20,000 and 30,000. Both island possessions are off the main routes of travel, with very little commercial or tourist intercourse with the outside world. On each island there is practically no caucasian population except for Navy personnel. It would be difficult to find two locations outside or within the continental limits of the United States wherein the environmental factors which might play a part in influencing veneral disease rates could be more closely similar, yet table 7 reveals that Guam consistently maintained a very low rate—lower in fact than has been the rate of any subdivision of this part of the study thus far encountered—whereas the annual rates for Samoa while fluctuating considerably were very materially higher with the exception of 1937 and 1938.

Table 7 indicates that the rates of forces ashore in China were higher than any other subdivision of the forces ashore. It was seen previously in graph 4 that the same applies to the forces afloat, viz, that the Asiatic Fleet maintained the highest admission rate.

In the second part of table 7 the rates shown under the column "10-year rate" for the Virgin Islands, Puerto Rico, Haiti, Nicaragua, and Alaska are not rates actually based on a 10-year experience in these localities, but are the rates for the period of time that naval activities were in these localities during the years 1929–38, inclusive, adjusted to a 10-year basis. For example, in the Virgin Islands there were 4 years of experience during the period of this study; in Puerto Rico, 3; in Haiti, 5; in Nicaragua, 5; and in Alaska only 2.

Allowing for the hazards of making a comparison of rates based upon periods which are not identical, it is still felt that such a comparison would provide a crude index for comparing with other localities for which there was a full 10-year experience. Comparing the rates derived from the total naval experience in each location, it is seen that in order of highest rates the list ranges from the highest to the lowest as follows:

Alaska_____ ⎫
Nicaragua_____ ⎬ With total experience admission rates of more than 100 per 1,000.
China_____ ⎭

Cuba_____ ⎫
Haiti_____ |
Puerto Rico___ ⎬ With total experience rates between 35 and 18 per 1,000.
Virgin Islands_ |
Guam_____ ⎭

TABLE 7.—*10-year gonorrhea study, United States Navy*

[Rates per 1,000 according to (a) naval districts, (b) shore duty outside territorial United States]

	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	10-year rate
(a) Naval districts											
1st Naval District (Maine, N. H., Vt., Mass., R. I.)	30.86	32.47	34.42	36.02	31.34	21.58	17.15	15.89	11.78	10.64	24.35
3d Naval District (Conn., N. Y., northern N. J.)	47.55	45.59	47.29	45.08	33.12	31.97	31.28	14.30	27.62	26.07	35.54
4th Naval District (Southern N. J., Pa., and Del.)	43.74	43.75	55.77	52.02	26.43	14.56	29.72	33.95	23.21	22.19	35.66
Activities: Potomac and Severn Rivers (Annapolis, Washington, Indian Head, Dahlgren, Quantico, and Anacostia)	27.07	23.68	26.25	23.94	22.11	23.23	25.55	15.83	20.55	16.69	22.13
5th Naval District (Md., Va., W. Va., part of N. C.)	47.47	50.41	54.46	51.04	46.36	35.99	46.16	38.63	30.14	34.76	42.65
6th Naval District (part of N. C., S. C., and Ga.)	28.75	46.46	42.91	32.41	26.53	16.19	17.04	8.01	9.32	10.34	26.18
7th Naval District (Fla., except western part)	49.08	10.58	44.03	36.10	43.39	33.23	35.49	25.34	19.90	35.04	33.27
8th Naval District (west Fla., Ala., Tenn., La., Miss., Ark., Okla., and Tex.)	56.25	46.42	39.31	28.04	17.30	28.99	7.24	9.91	7.62	5.49	35.64
9th Naval District (Ky., Ohio, Mich., Ind., Ill., Wis.)	56.22	45.14	38.38	44.21	40.17	29.28	24.19	23.84	28.11	27.25	25.48
11th Naval District (N. Mex., Ariz., and southern Calif.)	29.90	20.82	28.15	55.63	31.35	29.92	25.10	22.45	18.01	26.65	28.97
12th Naval District (Colo., Utah, Nev., northern Calif.)	35.94	34.74	87.09	27.75	27.00	45.99	29.84	24.74	19.90	30.20	36.08
13th Naval District (Wash., Oreg., Idaho, Mont., Wyo.)	45.29	42.98	50.41	25.73	25.34	17.41	20.47	23.61	18.73	13.99	34.17
14th Naval District (T. H.)	21.30	32.06	36.64	42.55	41.11	24.42	29.65	22.56	34.44	58.48	22.87
15th Naval District (C. Z.)	67.25	37.48	37.98	42.55	24.11	35.22	32.54	51.14	79.25	87.04	37.76
16th Naval District (P. I.)	32.68	67.32	82.24	96.14	58.08	35.22	32.54	51.14	79.25	87.04	61.37
Total	37.50	36.06	42.15	40.52	31.87	27.30	27.53	22.89	23.68	25.77	31.26
(b) Naval activities											
Virgin Islands	61.45	38.46	15.79								24.94
San Juan, P. R.		18.52	54.55								27.52
Haiti			60.39	68.40	36.36	66.66					49.66
Cuba	62.75		69.77	65.27	64.62	45.15	55.90	57.51	16.29	74.07	53.77
Nicaragua	25.48	35.91	62.37	132.72	61.76	78.65					121.10
Alaska	155.82	134.76									126.76
Guam	11.03	8.40	23.67	20.66	25.97	13.36	29.89	18.52	24.64	230.77	17.60
Samoa	19.80	80.00	40.09	22.60	89.89	60.90	92.78	34.09	18.18	16.82	35.86
China	151.91	160.74	153.25	189.34	108.17		76.87	75.60	45.11	11.43	115.72
Total	109.14	88.79	85.61	124.30	91.35	53.11	63.39	59.25	60.82	79.96	85.10

During this period the forces ashore in Haiti and Nicaragua were chiefly marine personnel and they were scattered in small communities.

In this part of the study it is evident that of the forces ashore: (1) Those within the continental limits of the United States had the lowest annual admission rate for acute gonococcus infection of the urethra. (2) Those outside the continental limits which are stationed in foreign countries had the higest rates. (3) Those outside the continental limits stationed in our own territorial and insular possessions had annual rates which lie intermediary to the two extremes above. In general, however, these latter more closely approach the rates of the continental forces.

It is reasonable to suppose that social and moral standards, interest in, and facilities for athletics and other healthful diversions, public health and venereal disease control measures, and the local attitude toward prostitution and vice among our extraterritorial possessions would in general follow the trends as they are found within the continental United States. In our outlying possessions, these standards may not be developed to as high a plane, owing to the distance from cultural and population centers, yet they would tend to reflect the attitudes and trends found in the mother country; and would consequently tend to exert their influence on the admission rates of venereal diseases in extracontinental land under the American flag.

As a further break-down of forces ashore it was considered to be of value to study the admission rates per 1,000 which occurred among personnel stationed ashore in cities which are Navy ports.

Table 8 lists the annual rates of various communities throughout the country which are centers of naval shore activities. These rates were composed from the naval average strength during each year of the forces on shore duty located in and around each of the communities indicated. In this table they are listed in the descending order of the highest 10-year rates.

In table 8 it is observed that the navy personnel stationed ashore in New Orleans, San Francisco, and Norfolk had annual rates which were relatively high by comparison with those in the remainder of the communities. The annual rate of Boston was increased during the first half of the study period, and then dropped to average during the second half.

TABLE 8.—*10-year gonorrhea study, United States Navy*

[Rates per 1,000 of forces ashore in cities which are naval ports]

Cities in United States listed in descending order of 10-year rate per 1,000	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	10-year rate
New Orleans, La	135.71	194.69	89.04	48.39	50.00						106.24
San Francisco, Calif	115.14	68.58	223.53	68.18	53.66	48.04	22.65	9.92	20.80	38.46	60.29
Norfolk, Va	47.65	51.90	54.73	51.18	47.17	36.80	46.36	38.80	30.25	35.44	43.10
Philadelphia, Pa	45.11	50.43	62.95	60.29	31.53	12.60	32.38	36.67	21.30	23.48	38.05
Boston, Mass	51.17	51.51	49.46	56.06	56.20	25.30	19.70	18.94	17.63	17.24	37.78
Bremerton, Wash	46.14	45.07	54.20	28.75	28.62	47.62	31.89	24.79	15.56	22.50	34.97
Pensacola, Fla	48.12	40.33	33.48	34.68	42.99	33.23	35.49	25.34	19.90	34.91	33.02
Charleston, S. C	36.27	46.15	41.18	34.48	48.05	40.70	25.83	14.41	17.01	9.97	32.03
Quantico, Va	40.70	28.27	44.28	44.32	37.95	33.90	33.59	20.16	24.69	18.20	30.81
San Diego, Calif	29.90	20.87	28.26	44.46	40.44	29.47	24.35	24.01	28.30	27.50	29.14
New York, N. Y	32.72	42.05	40.06	37.86	21.94	16.41	22.47	19.01	16.87	18.36	28.68
Seattle, Wash				13.16		23.26	9.35	24.39	33.43	47.01	28.12
Mare Island, Calif. (Vallejo)	20.62	19.67	49.59	50.29	18.32	17.77	20.63	27.55	15.82	21.23	26.00
Washington, D. C	40.55	51.25	30.30	23.11	26.50	25.93	29.04	13.97	15.04	12.04	25.59
Great Lakes, Ill. (Chicago)	56.22	45.14	38.38	28.04	17.30	28.99	7.24	9.80	7.62	5.49	25.48
New London, Conn	45.99	34.17	35.03	33.33	21.95	5.63	22.19	21.28	22.70	10.50	25.38
Parris Island, S. C	27.01	46.52	43.30	14.40	18.66	9.75	14.40	5.55	7.05	10.45	24.53
Portsmouth, N. H	23.75	25.75	21.33	28.95	15.87	24.76	15.66	14.73	22.73	7.92	20.84
Newport, R. I	23.01	24.36	32.49	25.62	25.12	14.84	15.74	14.89	5.69	8.56	18.32
Annapolis, Md	10.08	4.88	7.24	9.75	7.62	10.25	13.03	12.64	21.00	17.65	11.61
Total	36.51	35.11	40.58	39.05	31.42	26.99	27.17	22.65	21.71	23.17	30.11

TABLE 9.—*10-year gonorrhea study, United States Navy*

[Rates per 1,000 of forces ashore in cities outside continental United States]

Cities, navy ports outside continental United States listed in descending order of 10-year rate per 1,000	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	10-year
Sitka, Alaska										230.77	126.76
Shanghai, China	151.54	155.19	124.04	190.38	111.60	65.05	76.92	84.48	88.22	118.68	116.30
Peiping and Tientsin (China)	163.21	174.51	226.74	186.35	96.65	48.74	76.77	55.77	76.07	55.56	114.43
Manila area	31.75	66.67	86.68	10.24	58.77	37.76	32.26	57.46	84.30	91.84	64.25
Guantanamo Bay, Cuba	25.48	35.91	69.77	65.27	61.76	78.65	55.90	57.51	16.29	74.07	53.77
Coco Solo, C. Z. (Colon area)	67.25	37.48	37.98	42.55	21.11	24.42	29.65	22.56	36.36	60.87	38.12
Tutuila, Samoa	19.80	80.00	40.00	22.60	89.89		92.78	34.09	18.18	11.43	36.13
San Juan, P. R		18.52	54.55		36.36						27.52
St. Thomas, V. I	61.45	38.46	15.79			66.67					24.94
Pearl Harbor, T. H. (Honolulu area)	21.30	32.06	36.64	25.73	26.15	16.38	20.15	23.41	18.06	14.20	22.80
Balboa, C. Z. (Panama City area)										12.05	6.02
Total	64.52	71.80	74.74	84.70	54.17	35.77	38.25	40.39	44.53	57.91	56.29

Forces ashore in Annapolis had rates which were exceptionally low. It is believed that this can be accounted for by the fact that a considerable proportion of the naval population ashore at Annapolis is comprised of midshipmen and they are surrounded by rigid restrictions. Furthermore, Annapolis is a very small population center situated away from main arteries of travel. It is believed that these two factors tend to reduce the exposure rate, and consequently the annual admission rates among naval personnel stationed there.

As for the remainder of the communities, their rates show nothing of note although they are widely scattered.

Table 9 sets forth the annual rates and the 10-year rate of various communities outside the continental United States which were centers of naval activities ashore.

Shore activities at Sitka were not established on a large scale until the last 2 years of the study (1937 and 1938). The rate for Sitka, Alaska, shown in the 10-year rate column is in reality the rate based on 2 years combined experience at Sitka. During 1937 an average strength of 96 with no incidence of gonorrhea was reported. It will be interesting to follow this in subsequent years to determine whether this rate has remained high. It is quite possible that this rate is unusually high because this was the period of new construction incident to the establishment of the new naval base at Sitka. In large government construction projects in outlying sections a boom-town atmosphere prevails. Police and public health activities usually do not keep pace with the rapid expansion of the community. Under these conditions, vice and prostitution generally flourish. Upon the completion, occupation and active functioning of a new station, construction personnel are withdrawn, the community adopts a normal routine, and a drop in venereal disease rates is to be anticipated.

TABLE 10.—*10-year gonorrhea study, United States Navy*

[Rates per 1,000, all United States naval hospitals]

	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	10-year
HOSPITALS WITHIN CONTINENTAL UNITED STATES											
Naval hospital:											
Annapolis, Md	38.17	8.00	14.81	7.87	......	14.29	......	6.45	6.17	......	9.19
Charleston, S. C	18.52	34.48	......	94.59	14.93	56.60	......	......	33.90	......	27.49
Chelsea, Mass	41.01	45.75	56.48	42.42	37.19	19.86	26.32	......	17.54	20.20	34.02
Great Lakes, Ill	22.22	24.46	15.53	8.38	38.71	......	......	9.01	15.87	7.58	17.55
Mare Island, Calif	23.87	24.71	25.69	41.1ι	16.47	20.12	17.75	20.87	19.31	16.19	22.85
Newport, R. I	......	26.75	33.18	55.56	16.81	19.05	20.83	......	6.58	......	18.19
New York, N. Y	44.00	48.24	40.23	57.14	34.76	16.18	20.00	4.00	15.87	14.60	34.31
Portsmouth, Va	16.56	16.71	22.97	26.81	33.54	.32.67	25.35	9.65	7.38	6.87	19.56
Parris Is., S. C	19.80	39.37	16.95	......	9.90	......	......	......	......	......	10.21
Pensacola, Fla	80.81	78.74	49.18	49.18	50.51	53.76	22.22	35.71	8.93	8.62	43.96
Philadelphia, Pa	14.12	33.08	42.61	30.46	14.29	34.48	36.44	16.34	10.96	12.47	23.95
Portmouth, N. H	......	26.67	35.71	9.61	23.26	19.33	......	......	83.33	......	18.95
Puget Sound, Wash	57.14	41.67	44.55	20.08	41.04	26.82	27.03	19.76	12.50	4.27	28.72
San Diego, Calif	10.29	9.39	18.52	25.20	23.47	26.93	9.77	12.88	19.06	8.75	16.15
Washington, D. C	41.10	41.40	25.40	21.34	34.48	33.33	31.88	......	14.93	6.08	24.67
Total hospitals in United States	24.92	28.39	29.17	31.50	26.39	26.22	18.60	11.24	15.33	9.07	22.41
HOSPITALS OUTSIDE CONTINENTAL UNITED STATES											
Naval Hospital, Guam	98.90	104.17	179.78	129.87	148.15	76.92	112.50	12.99	......	12.50	89.37
Pearl Harbor, T. H	22.90	20.69	31.45	33.18	39.30	34.83	......	22.94	18.96	4.46	22.81
Canacao, P. I	45.30	61.22	100.42	128.21	62.50	62.20	38.46	34.93	54.55	57.35	64.42
Total hospitals outisde continental United States	49.12	57.61	92.40	90.04	65.37	53.28	34.84	26.72	31.37	30.87	52.88
Total all hospitals	27.23	30.98	34.89	36.99	30.83	29.34	20.46	12.96	16.98	11.56	25.56

TABLE 10a.—*10-year gonorrhea study, United States Navy—chi square determinations for naval hospitals—expected incidence derived from the 10-year rate for all hospitals*

[Degree of significance]

	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938
Naval hospital:										
Annapolis, Md	+	0	0	0	—	0	—	0	0	—
Charleston, S. C	0	0	0	++	0	0	0	0	0	0
Chelsea, Mass	0	+	++	+	0	0	0	—	0	0
Great Lakes, Ill	0	0	0	—	0	0	0	0	0	0
Mare Island, Calif	0	0	0	+	0	0	0	0	0	0
Newport, R. I	—	0	0	+	0	0	0	0	0	—
New York, N. Y	+	++	+	++	0	0	0	—	0	0
Portsmouth, Va	0	0	0	0	0	0	0	—	——	—
Parris Island, S. C	0	0	0	0	0	0	0	0	0	0
Pensacola, Fla	++	++	0	0	0	0	0	0	0	0
Philadelphia, Pa	0	0	+	0	0	0	0	0	—	0
Portsmouth, N. H	0	0	0	0	0	0	0	0	+	0
Puget Sound, Wash	+	0	0	0	0	0	0	0	0	—
Washington, D. C	0	+	0	0	0	0	0	—	0	—
San Diego, Calif	—	——	0	0	0	0	—	—	0	——
Totals	0	0	0	+	0	0	—	——	——	——
Naval hospitals:										
Guam	++	++	++	++	++	+	++	0	0	0
Pearl Harbor, T. H	0	0	0	0	0	0	—	0	0	—
Canacao, P. I	+	++	++	++	++	++	0	0	+	++
Totals	++	++	++	++	++	++	0	0	0	0
Grand total	0	+	++	++	+	0	—	——	——	——

Legend:
+ Higher significantly than expected incidence.
++ Much higher significantly than expected incidence.
— Significantly lower than expected incidence.
— — Much lower significantly than expected incidence.
0 No significant difference between actual and expected incidence.

Table 9 shows that for each year of the study the forces ashore in Shanghai, Peiping, and Tientsin, China, had annual rates which were the highest of any of these subdivisions of the forces ashore.

In this part of the study it is again demonstrated that: (1) The forces ashore, in communities outside the continental United States which were not in our territorial or insular possessions, had the highest rates (except the 2-year rate for Sitka, Alaska, which includes the construction period of this base). (2) In general, the communities within our continental boundaries had the lower rates. Among these latter, New Orleans, San Francisco, and Norfolk had the highest 10-year rates. (3) That the forces ashore located outside the continental United States, but in our insular and territorial possessions, had rates which in general ranged between (1) and (2).

At this point in the study of forces ashore it was considered of value to select and study the rates of the most standardized type of naval shore activity discoverable. As with the forces afloat, this was decided upon in order to determine if activities of a similar nature but varying in location had admission rates which were similar or dissimilar. It is believed that the shore activity which could supply data of sufficient size and which was a standardized unit with the most

uniform type of service, equipment, and personnel, is the naval hospital.

This part of the study was confined to hospital personnel, i. e., the hospital staff, since patients admitted for treatment are charged as an admission to the ship or station to which they were attached while on active duty when their infection was acquired.

Table 10 and graph 12 present the results of this part of the study.

Graph 12 illustrates that: (a) The annual admission rates for all naval hospitals varied between one-third to one-half of those for the entire Navy. (b) The hospitals located within the continental limits of our country had admission rates which were less than one-half of those in extracontinental locations. (c) That the hospitals outside the continental United States had combined annual admission rates which exceeded the annual rates of the entire Navy during 1931, 1932, and 1933. (d) These latter hospitals combined show a decidedly precipitous drop in annual rates between 1932 and 1936, paralleling a similar rapid decrease found in: (1) Forces ashore in China, (2) Sixteenth Naval District (Philippine Islands), (3) the Asiatic Fleet.

Table 10 shows that the annual admission rates of the naval hospitals in Charleston, S. C., Chelsea, Mass., Pensacola, Fla., and Bremerton, Wash. (United States Naval Hospital, Puget Sound) were significantly higher than were those of all hospitals combined. The annual admission rates of the New York, N. Y., hospital were higher than the combined hospital rates during the first half of the study period, and were lower than the combined rates during the second half.

Chi square significance tests show that these differences are significant whereas the differences in rates among the remaining hospitals within the continental limits are not significant. (Table 10a.)

These tests also confirm that the rates for Guam and Canacao (Manila) hospitals are significantly higher in all but 3 years of the study; whereas the Pearl Harbor hospital rate did not differ significantly at any time.

This part of the research reveals that: (1) The annual rates of all naval hospitals were consistently lower than the annual rate of all forces ashore; also that they were even lower than the rates of forces ashore within the continental boundary of the United States. (2) Those located within the continental limits had rates which were lower than those outside the continental boundaries. (3) The rates of the 15 hospitals located within the continental boundaries were not significantly different from each other or from the expected incidences derived from the 10-year rates of all hospitals. Of the three hospitals located outside the United States continental boundaries, the United States Naval Hospital, Pearl Harbor, Hawaii (Honolulu area), had annual rates not significantly different from

the 10-year rates of all hospitals. The other two had rates which were consistently and significantly higher during the first part of the study, and not significantly different during the latter few years.

Inasmuch as the naval personnel of a naval hospital is composed of officers of the Medical Corps, members of the Nurse Corps, and enlisted men and warrant officers of the Hospital Corps, all of whom are familiar with the Navy Medical Department's program and methods of venereal disease control, it is logical to expect that the annual rates of naval hospitals would be lower than the corresponding rates of the forces ashore in the community in which the hospital is located. To test this assumption, the rates of hospitals and of the remaining forces ashore in their respective communities were compared. The results of this comparison are set forth in table 11.

TABLE 11.—*10-year gonorrhea study, United States Navy*

[Comparison of hospital rates with the Navy rates of the forces ashore in cities in which the hospitals are located]

	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	Total
Hospitals and cities which are naval ports within continental United States											
Portsmouth, Va. (Norfolk) naval hospital	16.56	16.71	22.97	26.81	33.54	32.67	25.35	9.65	7.38	6.87	19.56
All naval activities, Norfolk area	47.65	51.90	54.73	51.18	47.17	36.80	46.36	38.80	30.25	35.44	43.10
Philadelphia, Pa., naval hospital	14.12	33.08	42.61	30.46	14.29	34.48	36.44	16.34	10.96	12.47	24.24
All naval activities, Philadelphia area	45.11	50.43	62.95	60.29	31.53	12.60	32.38	36.67	21.30	23.48	38.05
Chelsea, Mass., naval hospital	41.01	45.75	56.48	42.42	37.19	19.86	26.32		17.54	20.20	34.02
All naval activities, Boston area	51.17	51.51	49.46	56.06	56.29	25.30	19.70	18.94	17.63	17.24	37.78
Puget Sound, Wash., naval hospital	57.14	41.67	44.55	20.08	41.04	26.82	27.03	19.76	12.50	4.27	28.72
All naval activities, Bremerton	46.14	45.07	54.20	28.75	28.62	47.62	31.89	24.79	15.56	22.50	34.97
Pensacola, Fla., naval hospital	80.81	78.74	49.18	49.18	50.51	53.76	22.22	35.71	8.93	8.62	43.96
All naval activities, Pensacola	48.12	40.33	33.48	34.68	42.99	33.23	35.49	25.34	19.90	34.91	33.02
Charleston, S. C., naval hospital	18.52	34.48		94.59	14.93	56.60			33.90		27.49
All naval activities, Charleston	36.27	46.15	41.18	34.48	48.05	40.74	25.83	14.41	17.01	9.97	32.03
San Diego, Calif., naval hospital	10.29	9.39	18.52	25.20	23.47	26.93	9.77	12.88	19.06	8.75	16.15
All naval activities, San Diego area	29.90	20.87	28.26	44.46	40.44	29.47	24.35	24.01	28.30	27.50	29.14
New York, N. Y., naval hospital	44.00	48.24	40.23	57.14	34.76	16.18	20.00	4.00	15.87	14.60	34.31
All naval activities, New York area	32.72	42.05	40.06	37.86	21.94	16.41	22.47	19.01	16.87	18.36	28.68
Mare Island Calif., naval hospital	23.87	24.71	25.69	41.19	16.47	20.12	17.75	20.87	19.31	16.19	22.85
All naval activities (Vallejo) area	20.62	19.67	49.59	50.29	18.32	17.77	20.63	27.55	15.82	21.23	26.00
Washington, D. C., naval hospital	41.10	41.40	25.40	21.34	34.48	33.33	31.88		14.93	6.08	24.67
All naval activities, Washington area	40.55	51.25	30.30	23.11	26.50	25.93	29.04	13.97	15.04	12.04	25.59
Great Lakes, Ill., naval hospital	22.22	24.46	15.53	8.38	38.71			9.01	15.87	7.58	17.55
All naval activities, Great Lakes (Chicago) area	56.22	45.14	38.38	28.04	17.30	28.99	7.24	9.80	7.62	5.49	25.48
Parris Island, S. C., naval hospital	19.80	39.37	16.95		9.90						10.21
All naval activities, Parris Island	27.01	46.52	43.30	14.40	18.66	9.73	14.40	5.55	7.05	10.45	24.53
Portsmouth, N. H., naval hospital		26.67	35.71	9.61	23.26	16.13			83.33		18.95
All naval activities, Portsmouth N. H.	23.75	25.75	21.33	28.95	15.87	24.76	15.66	14.73	22.73	7.92	20.84
Newport, R. I., naval hospital		27.65	33.18	55.56	16.81	19.05	20.83		6.58		18.19
All naval activities, Newport area	23.01	24.36	32.49	25.62	25.12	14.84	15.74	14.89	5.69	8.56	18.32
Annapolis, Md., naval hospital	38.17	8.00	14.81	7.87		14.29		6.45	6.17		9.19
All naval activities, Annapolis	10.08	4.88	7.24	9.75	7.62	10.25	13.03	12.64	21.00	17.65	11.61

TABLE 11.—*10-year gonorrhea study, United States Navy*—Continued

	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	Total
Hospitals and cities which are naval ports outside continental United States											
Canacao, P. I., naval hospital	45.30	61.22	100.42	128.21	62.50	62.20	38.46	34.93	54.55	57.35	64.42
All naval activities, Manila area	31.75	66.67	86.68	10.24	58.77	37.76	32.26	57.46	84.30	91.84	64.25
Pearl Harbor, T. H., naval hospital	22.90	20.69	31.45	33.18	39.30	34.83		22.94	18.96	4.46	22.81
Pearl Harbor, Honolulu area	21.30	32.06	36.64	25.73	26.15	16.38	20.15	23.41	18.06	14.20	22.80
Guam, naval hospital	98.90	104.17	179.78	129.87	148.15	76.92	112.50	12.99		12.50	89.37
All naval activities, Guam area							11.27	19.72	29.41	17.62	6.03

In table 11, it is seen that this assumption is not consistently true. Exceptions to it are found in table 11 in the following instances (only those hospitals for which annual admission rates were higher more than 2 years are listed):

United States naval hospital:

Years in which hospital annual admission rates were higher than corresponding community rates

    Chelsea, Mass. (Boston) _____ 1931, 1936, 1938.

    Pensacola, Fla _____ 1929, 1930, 1931, 1932, 1933, 1934, 1936.

    Charleston, S. C _____ 1932, 1934, 1937.

    New York, N. Y _____ 1929, 1930, 1932, 1933.

    Mare Island, Calif. (Vallejo) _____ 1929, 1930, 1934, 1937.

    Washington, D. C _____ 1929, 1933, 1934, 1935.

    Great Lakes, Ill. (Chicago area)___ 1933, 1937, 1938.

    Portsmouth, N. H _____ 1930, 1931, 1933, 1937.

    Newport, R. I _____ 1930, 1931, 1932, 1934, 1935, 1937.

    Annapolis, Md _____ 1929, 1930, 1931, 1934.

    Canacao, Phillppine Islands (Manila area). — 1929, 1931, 1932, 1933, 1934, 1935.

    Pearl Harbor, Hawaii (Honolulu area). — 1929, 1932, 1933, 1934.

Outstanding in this part of the study are the curious findings pertaining to the naval hospital at Guam. As stated above, the rates for the naval activities at Guam were unusually low, and in fact were the lowest among the forces ashore outside the continental limits of the United States. The naval activities ashore in Guam, exclusive of the hospital, reported no cases during the 6-year period 1929–34 inclusive, despite an average strength ranging from 365 to 1,094. On the other hand, the naval hospital, Guam, with an average strength ranging from 77 to 96, reported cases among their personnel with annual admission rates varying between 12.99 and 179.78 per 1,000. No explanation was found for this unusual variance.

By applying significance tests (chi square determinations, in which the 10-year rate combined of the hospitals and their local activities

were used to obtain the expected incidence), it was seen in table 11(a) that in general the hospital annual admission rates were not, for any significant period of time, consistently lower than the rates of the other naval activities in the communities in which the hospitals were located. The naval hospital at Guam whose personnel was less than the remainder of shore activities there, reported all of the cases during the 6-year period 1929–34, inclusive. The other activities ashore at Guam reported no cases during this period.

TABLE 11a.—*10-year gonorrhea study, United States Navy—chi square determinations of hospitals and cities in which they are located—expected incidence derived from combined hospital and city rate (.0379218032)*

Hospitals and cities	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938
Portsmouth, Va. (Norfolk) naval hospital	—	—	—	0	0	0	0	--	--	--
Naval activities, Norfolk area	++	++	++	++	+	0	—	0	—	0
Philadelphia, Pa., naval hospital	—	0	0	0	—	0	0	—	—	--
Naval activities, Philadelphia area	0	+	++	++	0	--	0	0	--	--
Chelsea, Mass., naval hospital	0	0	0	0	0	0	0	0	0	0
Naval activities, Boston area	+	+	+	+	+	0	—	—	—	—
Puget Sound, Wash., naval hospital	0	0	0	0	0	0	0	0	—	—
Naval activities, Bremerton area	0	0	+	0	0	+	0	—	--	—
Pensacola, Fla., naval hospital	+	+	0	0	0	0	0	0	0	0
Naval activities, Pensacola area	0	0	'0	0	0	0	0	—	--	0
Charleston, S. C., naval hospital	0	0	0	+	0	0	0	0	0	0
Naval activities, Charleston area	0	0	0	0	0	0	0	—	—	—
San Diego, Calif., naval hospital	--	--	--	—	—	0	--	--	--	
Naval activities, San Diego area	—	--	--	+	0	—	--	--	--	
New York, N. Y., naval hospital	0	0	0	+	0	—	0	—	—	—
Naval activities, New York area	0	0	0	0	—	--	—	+	--	—
Mare Island, Calif., naval hospital	0	0	0	0	—	—	—	—	—	—
Naval activities, Mare Island (Vallejo)	--	--	+	+	--	--	--	--	--	
Washington, D. C., naval hospital	0	0	0	—	0	0	0	0	—	—
Naval activities, Washington area	0	+	0	--	—	—	—	--	--	
Great Lakes, Ill., naval hospital	0	0	—	—	0	0	0	0	0	—
Naval activities (Great Lakes), Chicago	++	0	0	—	--	0	--	--	--	--
Parris Island, S. C., naval hospital	0	0	0	0	0	0	0	0	0	0
Naval activities, Parris Island area	—	+	0	0	—	--	--	--	--	--
Portsmouth, N. H., naval hospital	0	0	0	0	0	0	0	0	0	0
Naval activities, Portsmouth area	—	0	—	0	—	0	—	0	--	
Newport, R. I., naval hospital	0	0	0	0	0	0	0	0	—	0
Naval activities, Newport area	—	—	0	--	--	--	--	--		
Annapolis, Md., naval hospital	0	0	0	—	0	0	0	—	—	0
Naval activities, Annapolis area	--	--	++	--	—	--	--	--	--	
Canacao, P. I., naval hospital	0	+	++	++	+	+	0	0	0	0
Naval activities, Manila area	0	++	++	++	++	0	0	+	++	++
Pearl Harbor naval hospital	0	0	0	0	0	0	0	0	0	—
Naval activities, Pearl Harbor, Honolulu area	--	0	0	--	--	--	--	--	--	
Guam naval hospital	+	++	++	++	++	+	++	0	0	0
Naval activities, Guam area	0	0	0	0	0	0	—	—	0	—

Legend:
+ Significantly higher.
++ Very significantly higher.
— Significantly lower.
-- Very significantly lower.
0 No significant difference.

AN ANALYSIS OF THE NEW ADMISSION RATES OF THE VARIOUS MAJOR OCCUPATIONAL GROUPS IN THE NAVY

Turning to a comparison of annual admission rates according to occupations, as the next step, a great deal of interesting data is found.

Table 12 contains the annual admission rates per 1,000 according to major occupational groups within the United States Navy.

TABLE 12.—*10-year gonorrhea study, United States Navy*

[Rates per 1,000 according to major occupational (or sociological subdivisions)]

Occupations	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	10-year rate
Aviation cadets:											
Navy							11.11	7.03	12.36	9.13	9.80
Marine											
Total, aviation cadets							10.20	6.62	11.43	8.45	9.10
Navy officers	1.79	1.66	1.52	1.05	1.90	1.36	1.44	1.21	.60	.29	1.27
Marine officers				.82					1.47	2.18	.48
Total, officers	1.58	1.46	1.34	1.03	1.69	1.21	1.28	1.07	.70	.51	1.18
Midshipmen	.54	1.54	1.02	.56	2.45	4.43	5.71	4.71	2.36	2.82	2.60
Marines	78.94	77.77	80.75	92.94	72.91	54.95	53.15	45.79	43.56	43.52	64.43
Marine musicians	79.01	80.33	66.99	76.92	80.84	52.81	32.18	54.89	57.44	35.62	61.15
Total enlisted men, marines	78.94	77.82	80.42	92.59	73.08	54.91	52.59	46.03	43.87	43.36	61.35
Prisoners	4.40	4.73	3.80	1.76	12.99	6.54	9.13	5.15			4.60
Nurses (female)											
Electricians	65.62	62.04	71.45	63.99	45.27	39.12	31.97	23.54	30.24	34.91	45.70
Engine room	57.81	49.25	48.11	48.46	31.25	31.71	28.27	22.89	25.51	29.81	37.29
Fireroom	115.81	114.84	130.17	131.10	101.89	92.14	84.58	68.89	74.06	86.32	99.23
Clerical	59.55	50.81	55.05	57.30	41.58	30.06	31.03	27.18	25.36	32.25	40.63
Culinary	50.72	52.71	52.17	50.23	43.22	51.50	63.49	74.87	68.15	90.24	60.51
Hospital	38.04	45.07	39.29	42.17	35.43	26.55	22.86	10.22	17.28	11.48	29.33
Navy musicians	57.14	44.62	41.70	52.59	39.68	42.65	45.34	28.05	29.71	32.26	41.74
Aviation	32.25	37.18	31.69	32.98	26.15	27.66	19.14	18.67	17.07	21.29	25.42
Apprentices	32.92	34.45	32.73	18.41	16.37	22.03	16.99	15.50	12.35	9.73	20.28
Ordnance	53.73	53.29	61.22	62.87	37.48	29.25	26.48	28.48	24.87	34.98	40.68
Seamen	110.74	113.37	122.78	127.24	109.26	93.67	82.57	67.76	65.32	83.59	95.83
All others	66.09	58.09	62.59	80.75	46.08	42.45	31.17	29.68	26.97	36.53	47.03
Total enlisted men, Navy	82.93	82.61	89.07	90.97	73.71	63.93	58.26	49.30	49.57	60.96	69.21

Graphs 13 to 16, inclusive, show a comparison of these rates.

The most unusual finding thus far discovered in the entire study is discerned under the occupation of nurse, where in 4,356 nurse years of experience in the United States Navy, *not one case of gonococcus infection was reported.* Members of the Navy Nurse Corps are a very high type, carefully selected by competitive examination; however, it is almost inconceivable that in 4,356 person years of human experience in any occupation not a single case of gonorrhea should have occurred. In searching for an explanation of this finding several possible contributory circumstances must be considered.

Let us examine the background of this situation. After a careful selection from many applicants for appointment, each nurse is required to serve a probationary period of 6 months. If anything questionable arises regarding her character during this period a permanent appointment is withheld. Navy nurses, similarly to officers, are required to undergo annual physical examinations. There

Graph 13.

TEN-YEAR GONORRHEA STUDY - U.S. NAVY
Rate Per 1,000 of Officers and Associated
Groups Compared With Entire Navy
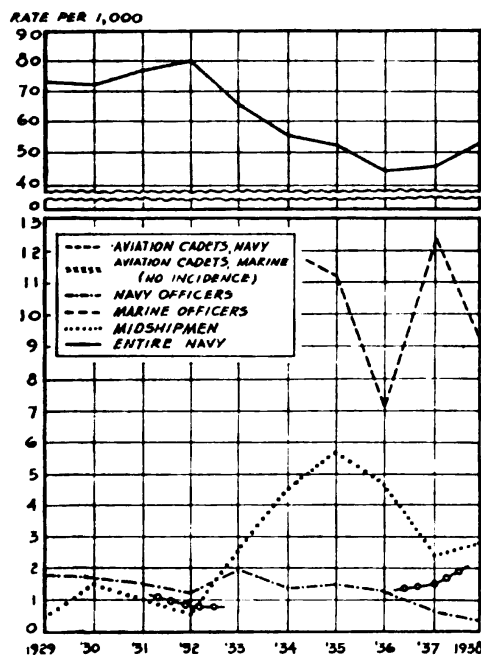
Graph 14.

TEN-YEAR GONORRHEA STUDY - U.S. NAVY
Comparison of Rates of Enlisted Men, Marine
and Enlisted Men, Navy with the Entire Navy
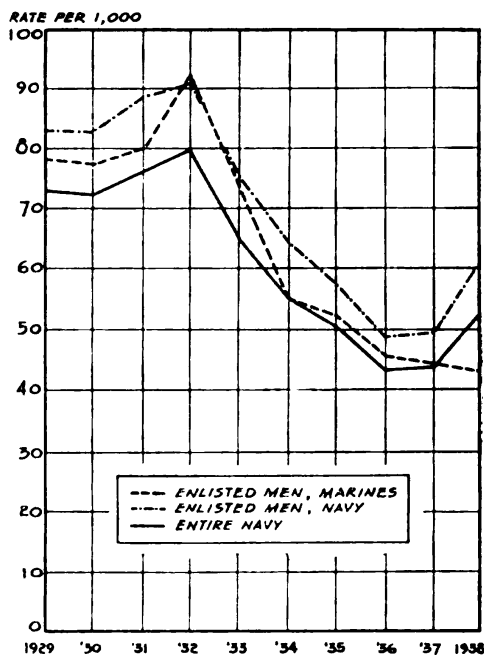
Graph 15.

TEN-YEAR GONORRHEA STUDY - U.S. NAVY
Comparison of Rates by Occupation
of Enlisted Men, Navy
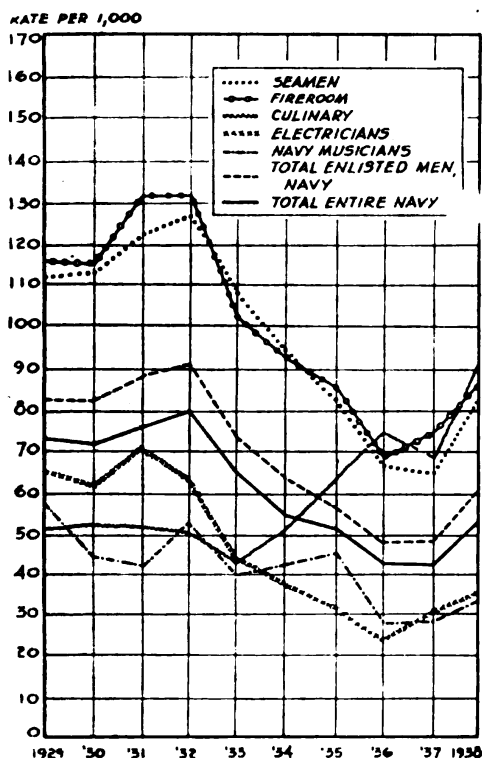
Graph 16.

TEN-YEAR GONORRHEA STUDY - U.S. NAVY
Comparison of Rates by Occupation
of Enlisted Men, Navy
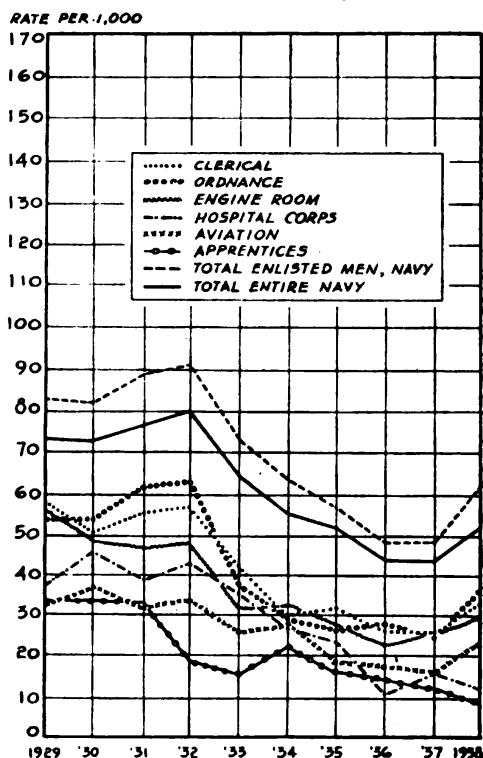
FIGURE 3.

444428—42——17

is, however, nothing in regulations which requires the examining medical officer to perform a pelvic examination on a nurse. However, in view of the question of courtesy and ethics involved it is believed that pelvic examinations are not performed on nurses anywhere throughout the Navy in the course of their annual physical examination. Hence any gonorrheal infection occurring among the Navy nurses would not be discoverable unless reported by the individual infected.

There is no regulation or policy which requires that a nurse be discharged from the service for contracting a venereal disease. Therefore, theoretically, there should be no reason for concealment of a gonorrheal infection. Actually, however, the psychological factor is very powerful reason, and it would be only human for any nurse who might contract gonorrhea to seek treatment from some civilian physician—a total stranger—rather than to report and receive treatment from the medical officers with whom she is associated professionally in a naval hospital or on a hospital ship.

Graph 13 and table 12 illustrate the annual admission rates of officers and similar occupational groups.

The officer and associated groups consist of:

1. Officers, United States Navy.
2. Officers, United States Marine Corps.
3. Midshipmen.
4. Aviation cadets, United States Navy.
5. Aviation cadets, United States Marine Corps.

Aviation cadets did not come into existence in the United States Navy until 1935, so that only 4 years of experience in this occupation were obtainable.

In 158 man years of experience among the Marine aviation cadets not one case of acute gonorrhea was reported. By comparison, 4 years of observation of naval aviation cadets totaling 2,040 person years of naval experience) show that their rates varied between 6.62 and 11.43 per 1,000.

In this part of the study the officers of the United States Marine Corps, with 12,526 person years of experience in the Navy, had only 6 cases with a 10-year combined rate of 0.48 per 1,000. The naval officers' 10-year rate was 1.27 (approximately 225 percent higher than that of the Marine officers).

Graph 13 reveals how extremely low the new admission rates of the officer group were by comparison with the annual rates of the entire Navy. Also it shows that the naval aviation cadets had the highest rates among the officer and similar occupational groups during the 4 years in which they were in existence. The midshipmen rates were the lowest of this group during 1929, 1930, 1931 and 1932.

then rose to second place in the associated officer group during the remaining years of the study period. Graph 13 indicates that the admission rates of naval officers remained comparatively steady, and consistently low, being third lowest of all in the entire occupational grouping; only the rates of the Marine Corps officers and Marine Corps aviation cadets were lower.

Graph 14 establishes: (1) That the annual rates for enlisted men of the Navy were repeatedly higher than the combined rate for the entire Navy. Furthermore they were higher than the annual admission rates for enlisted men of the Marine Corps. (2) Marine Corps enlisted men's annual rates were higher than the annual combined rates of the entire Navy.

Graphs 15 and 16 set forth the rates of occupations among enlisted men. It presents the fact that seamen and fireroom groups had rates which were closely similar and which were the highest among all occupational groups. Both of these occupational rates reflect the general trend of the annual rates of the entire Navy. Both were considerably and significantly higher than were the annual rates of the entire United States Navy. They were also higher than the combined rates of all the enlisted personnel of the Navy.

Graph 15 reflects very accurately a change in naval policy affecting the culinary group. This group is composed of mess boys, mess cooks, bakers, officers' cooks, and mess stewards. Prior to 1934 a great percentage of this group was made up of Filipinos. When Congress passed the bill to provide for the independence of the Philippine Islands by 1945, the Navy policy was changed—no new Filipino enlistments were accepted and American negroes were enlisted to replace them in these occupations. However, those Filipinos who were already enlisted in the Navy were permitted to remain. It is seen in graph 15 that the annual occupational admission rate for acute gonococcus infection of the urethra for this group, which had been ranging between 42 and 53 per 1,000, began to increase and was still rising at the end of the period under consideration.

Graphs 15 and 16 indicate how the annual rates for the following occupations were grouped, all of which show differences that are not statistically significant from one another: (a) Navy musicians, (b) clerical personnel, (c) ordnance personnel, (d) engine room personnel. The following occupations are found in the lowest admission rate brackets: (1) hospital corpsmen, (2) aviation personnel, and (3) apprentices; these latter two groups had consistently low rates, which were significantly lower than the combined Navy rates.

The classification "prisoners" is composed of men serving sentences in the naval prisons at Portsmouth, N. H., and Mare Island, Calif., and general court-martial prisoners. Since these men are actually

in confinement it would be impossible for them to expose themselves
to venereal disease. Therefore, it must be presumed that they were
exposed prior to actually assuming the status of prisoner. Only 25
such cases were reported during the 10-year period. Actually these
cases should be charged to the occupations in which these men were
engaged prior to assuming the prisoner status. However, it was not
possible to adjust for this.

This part of the study may be summed up as follows:

1. The nurses as a occupational group were outstanding in that there was no
incidence of acute gonorrhea reported in 4,356 nurse years of experience.

2. The officer and related occupations had unusually low rates.

3. Among the officer group the lowest rates were attained by the Marine Corps
aviation cadets and the officers of the Marine Corps.

4. Both Navy enlisted men and Marine Corps enlisted men had annual rates
which exceeded those for the entire Navy.

5. The annual admission rates of the Navy enlisted men were consistently
higher than those of the enlisted men of the United States Marine Corps.

6. Hospital Corps personnel, aviation personnel and apprentices had the
lowest rates among all enlisted men.

To be Continued

STATISTICS

HEALTH OF THE NAVY

The statistics (annual rates per 1,000) appearing in this summary were compiled from data contained in monthly reports of communicable diseases received in the Bureau for the months of July, August, and September 1941.

ENTIRE NAVY

Year	All diseases	Injuries and poisonings	All causes	Communicable diseases		Venereal diseases
				A	B	
1936	336	67	404	24	88	49
1937	377	61	439	20	101	59
1938	332	57	389	7	72	81
1939	325	52	377	3	59	93
1940	386	50	436	16	104	82
1941	338	48	386	15	82	51

FORCES ASHORE

1936	416	69	486	29	120	38
1937	508	64	571	31	168	37
1938	342	52	394	10	92	39
1939	330	50	380	2	78	48
1940	367	50	417	13	114	51
1941	352	49	401	22	95	31

FORCES AFLOAT

1936	291	66	357	21	70	55
1937	302	60	362	13	63	72
1938	327	60	387	5	60	105
1939	322	54	376	4	49	117
1940	403	50	453	19	96	108
1941	324	48	372	9	70	72

Common infectious diseases of the respiratory type.—These diseases caused 7,290 admissions during July, August, and September 1941— 4,060 from shore stations in the United States, 147 from foreign shore stations, and 3,083 from forces afloat. Catarrhal fever was responsible for 5,302 of the admissions.

Ships and shore stations reporting the greatest number of cases were as follows:

Ship or station	July	August	September	Total
Naval Training Station, Great Lakes, Ill	167	228	160	555
Naval Air Station, Jacksonville, Fla	73	85	119	277
Naval Training Station, Newport, R. I	85	69	75	229
Naval Training Station, San Diego, Calif	69	80	64	213
Marine Corps Base, San Diego, Calif	58	86	52	196
Naval Air Station, Pensacola, Fla	65	51	71	187
Marine Barracks, Parris Island, S. C	38	74	35	147
Naval Air Station, Corpus Christi, Tex	42	39	49	130
First Marine Division, Fleet Marine Force	43	55	24	122
U. S. S. *Houston*	8	93	11	112
Naval Air Station, Norfolk, Va	30	42	32	104
Submarine Base, Coco Solo, C. Z	30	29	22	81
Naval Air Station, San Diego, Calif	28	17	25	70
Submarine Base, New London, Conn	20	28	21	69
U. S. S. *Ranger*	25	21	19	65
Battle Force, Fleet Air Detachment	11	27	26	64
U. S. S. *North Carolina*	13	24	25	62

Catarrhal fever, acute—U. S. S. *Houston*—(*Special report dated August 26, 1941*).—A mild epidemic of catarrhal fever, acute, occurred aboard this vessel during the period August 12 to August 26, 1941.

There were approximately 100 admissions to the sick list during this period. Temperatures ranged from 99° F. to 104° F. and the patients complained particularly of general malaise with headache and severe backache. The outstanding feature was that there was no cough in these cases. White blood counts on cases with temperatures of 101° F. and over were found to be relatively low.

Treatment consisted of bed rest, forced fluids, light diet, and aspirin, phenacetin and Dovers powder capsules. There was an average of three sick days per case. No lung complications were noted.

Pharyngitis, acute—U. S. S. *Wakefield*—(*Special report dated August 2, 1941*).—A small epidemic of acute pharyngitis complicated by tonsillitis occurred among the troops on board during the latter days of July. Overcrowding, poor ventilation, exposure to bad weather; and, principally, lack of proper sterilization of messgear were considered the factors causing the spread. No cases occurred among troop or ship's officers who mess separately and whose messgear was washed by mess attendants. Few cases occurred in ship's personnel whose gear was handled separately. The troops' sculleries were manned by troops and there were many troops in the galley helping prepare food. Good dish washing was not possible because water restrictions were applied and there was no hot water with which to scald dishes. Four days after steam was connected to the scalding jets in the washing machines, and closer attention was given to keeping wash and rinse water hot, the admission rate began to fall. No people who recovered from the disease were allowed to work in the galley or sculleries.

Throat smears on several cases showed small Gram negative cocci and large Gram positive cocci in about equal numbers. Some streptococci and bacilli were found. No cultures were made.

The cases averaged about 4 to 5 days on the sick list, and usually had fever for about 48 hours, unless complicated by tonsillitis. Two showed albuminuria. Eight had peritonsillar abscesses. Many of the patients had earaches, but no cases of otitis media were recorded.

The treatment was bed rest, gargles, nose sprays, sulfanilamide, and symptomatic treatment. Messing was facilitated by serving only food which could be eaten with a spoon and bowl, a cereal in the morning, stewed fruit at noon and thick vegetable or meat soup at night. Oranges and cold drinks also were served. This was accepted well.

The following table shows the daily record of admissions for troop personnel:

Date	Tonsillitis, acute	Pharyngitis, acute	Date	Tonsillitis, acute	Pharyngitis, acute
July 13	1	1			
July 14	2	0	July 24	10	16
July 15	2	2	July 25	0	14
July 16	0	0	July 26	54	12
July 17	0	2	July 27	15	10
July 18	0	0	July 28	16	13
July 19	0	2	July 29	5	9
July 20	2	4	July 30	14	8
July 21	0	3	July 31	6	1
July 22	0	1			
July 23	13	10	Total	140	108

On July 25 the sick report was made up before the morning influx of patients, and after sick call on July 27. Total figures for these dates should be nearer 35 and 45 instead of 14 and 66.

Other infectious diseases.—There were 130 admissions for measles, 420 admissions for German measles, and 415 admissions for mumps during July, August, and September 1941. Ships and shore stations reporting the greatest number of admissions were as follows:

Ship or station	German measles	Measles	Mumps
U. S. S. *Altair*	2	0	28
U. S. S. *Astoria*	0	0	17
U. S. S. *Augusta*	0	0	14
First Marine Division, Fleet Marine Force	16	2	13
U. S. S. *Northampton*	0	0	23
U. S. S. *Raleigh*	0	0	26
U. S. S. *St. Louis*	0	0	15
Naval Training Station, Newport, R. I	67	0	0
Naval Training Station, Great Lakes, Ill	32	0	13
Naval Training School, Los Angeles, Calif	37	4	0
Marine Corps Base, San Diego, Calif	33	19	8
Naval Air Station, San Diego, Calif	3	1	22
Naval Training Station, San Diego, Calif	158	48	51
Naval Air Station, Alameda, Calif	2	6	18
District Headquarters, Balboa, C. Z	0	14	0

Septic sore throat.—There were 31 cases of this disease reported for the quarter, 7 from forces afloat and 24 from forces ashore. Ten of the 24 cases occurring at shore stations were reported by the Naval Training School, Noroton, Conn.

Chickenpox.—Eleven cases of chickenpox were reported for the quarter, two cases from the Naval Training Station, San Diego, Calif., and single cases from two ships and seven other shore stations.

Scarlet fever.—Admissions for scarlet fever for the quarter were reported as follows: Naval Training Station, Great Lakes, Ill., 3; Naval Training Station, Norfolk, Va., 2; and Section Base, Treasure

Island, Calif.; Marine Detachment, Peiping, China; District Headquarters, New York, N. Y., and the U. S. S. *California*, 1 case each.

Poliomyelitis, anterior, acute.—Single cases of poliomyelitis were reported by the Naval Academy, Annapolis, Md. (other than midshipmen); Naval Reserve Aviation Base, Atlanta, Ga.; Naval Air Station, Pensacola, Fla.; Navy Yard, Cavite, P. I.; Naval Station, Olongapo, P. I.; and the U. S. S. *Langley*.

Diphtheria.—One case of diphtheria was reported by the Naval Training Station, Great Lakes, Ill., and one case from the Naval Hospital, Pearl Harbor, T. H.

Cerebrospinal fever, meningococcic.—The U. S. S. *Boise* reported one case of cerebrospinal fever, meningococcic, in July.

Typhus fever.—Three cases of mild and two cases of moderately severe typhus fever were admitted to the Regimental Hospital, Fourth Marines, Shanghai, China, during the quarter.

Dysentery, bacillary—U. S. S. *Louisville*—(*Special report dated September 5, 1941*).—On July 15, 1941, an outbreak of acute gastrointestinal illness developed among the crew. The first cases were seen at evening sick call and by 0800 the following day, 25 had been admitted from different divisions for treatment and a smaller number had been treated ambulatory. Twenty-one additional cases were admitted by 0800 on July 17. The Marine compartment which adjoins the sick bay was made available for patients and proved quite satisfactory, as one of the crew's heads is located in close proximity. In order to further relieve congestion in the sick bay, 8 cases were transferred to hospital. Only 4 new cases were admitted up to 0800 on July 18, and during the succeeding 24 hours there were no admissions. On July 20, 12 new cases were admitted, after which the admission rate rapidly declined until August 2, when the epidemic terminated. All divisions were affected and 5 of the younger officers of the wardroom mess were admitted with mild symptoms. No other messes were affected.

The sudden onset of acute gastro-intestinal complaints among a large number of the crew on July 15 suggested at first some type of food infection, probably resulting from contaminated food served at either the noon or evening meal on that day. The noon meal consisted of macaroni soup, roast pork, mashed potatoes, stewed corn, gravy, raisin pie, bread, butter, and iced tea. The evening meal consisted of beef croquettes, baked brown beans, boiled lima beans, gravy, vegetable salad, bread pudding, bread, butter, and iced tea. Both meals were inspected shortly before being served and appeared, in every respect, wholesome. No appreciable time interval had elapsed between preparation of the food and serving of the meals. None of the men affected attributed their illness to food eaten at either of these

two meals. None of the food served was available for bacteriological study but portions of the pork which had been thawed and cut but not cooked were found in the ship's refrigerator. Samples of this meat were cultured and reported contaminated with Salmonella enteritidis. This organism was not recovered from any of the stools cultured.

The subsequent course of the epidemic, the symptoms observed among the men more seriously affected, and especially the character of their stools, suggested a mild type of bacillary dysentery instead of some type of food infection. Stools from three of the more serious cases treated on board were cultured at the hospital and Bacillus Shigella paradysenteriae (Sonne) was isolated. In view of the close similarity of symptoms observed among the cases in this ship to those reported during other epidemics, and the presence of Bacillus Shigella paradysenteriae (Sonne) in three stools cultured, the epidemic is believed to have been a mild type of bacillary dysentery caused by this organism.

The symptoms were similar in all cases, differing only in degree of severity. The following symptoms were most common: Lower abdominal cramps; frequent watery stools averaging 10 to 15 per day; nausea and vomiting; general weakness and malaise; fever from 100° F. to 105° F.; fronto-occipital headache; loss of appetite; tenesmus; fresh blood in stools; weight loss, 5 to 10 pounds in severer cases; blood counts in approximately 10 percent of cases showed leukocytosis of moderate degree, with absolute increase of granulocytes. In one case the count was 21,000.

On gross examination the stools, especially in the severer cases, appeared dysenteric in consistency; brownish-green in color; and quite liquid, tinged with blood, and containing mucus. Microscopically many granulocytes and R. B. C. were noted. Gram's stain showed a Gram-negative bacillus predominating but Gram-positive cocci (morphologically staphylococci) and some Gram-positive diplococci were noted in most stools examined.

The treatment in all cases was symptomatic. A high enema consisting of 5 percent sodium bicarbonate in normal saline was administered to most patients and repeated as indicated, with prompt relief of abdominal cramps and frequency of stools. Milder cases were given castor oil. All of the patients received camphorated tincture of opium and about one-half received both opium and bismuth subnitrate. Fluids were forced in all cases, mainly as clear soup and water. Cooked cereal and soft diet during convalescence. Twelve of the severer cases were given approximately 1,000 cc. of 5 percent glucose in saline intravenously with definite relief of symptoms, especially the lowering of high temperatures. This opportunity

was taken to instruct the Corpsmen in the technique of intravenous medication and the indications for this form of treatment. An opportunity was also afforded for practical instruction in concurrent disinfection.

The following control measures were instituted:

1. Concurrent disinfection practiced in sick bay.

2. Sentries placed at all washrooms and heads to require men to wash hands after going to toilet. Washrooms were supplied with soap and paper towels.

3. Information disseminated concerning dysentery and its prevention.

4. Inspection of mess cooks and mess gear before each meal. Mess cooks instructed concerning dysentery and required to scrub hands before serving.

5. Disinfectant solution provided for all food handlers including men detailed to prepare fruits and vegetables served raw.

6. Close supervision of scullery.

7. Drinking water boiled and fresh water tanks chlorinated until free of pathogenic bacteria.

The presence of "carriers" was suspected as new cases continued to report for treatment. Personnel engaged in the preparation and serving of food were questioned and none gave history of having suffered from dysentery or of having had any recent gastro-intestinal upsets. No recent changes had been made among the personnel of the galley, bakery, or butcher shop. Some changes had been made among the mess cooks as men completed their turns at this detail, but in no instance was there evidence that men assigned to mess cooking might be "carriers." Stool cultures from mess cooks, ship's cooks, butchers and Ship's Service personnel were negative. No change in the established routine for preparing and serving food was discovered. All perishable foods were properly stored in the ship's refrigerator and chill rooms, which were functioning efficiently. Fresh milk was not being served on the general mess. Powdered (Klim) milk is served twice per week with dry cereal for breakfast, but is kept in the ship's refrigerator after preparation and until immediately before being served; it is not considered a cause of the epidemic.

No fresh water had been taken from shore since March 27. Samples of water from the fresh water tanks were cultured and reported negative on May 10 for pathogenic bacteria. As fresh water had been made by the ship's evaporators from harbor water during the period of July 1 to July 7, samples from all of the ship's tanks were again cultured; all samples were found free of pathogenic

bacteria. While awaiting this report, all drinking water used on board was boiled and the fresh water tanks chlorinated. The average saline content of water made by the ship's evaporators from June 15 to July 15 was one grain per gallon. No harbor water had been allowed on board except for flushing purposes in the heads and pumping through fire hose at drills.

The dishwashing machine in the scullery is an obsolete hand-operated type which has required repairs from time to time. Due to a breakdown of this apparatus, mess gear could not be properly sterilized during the period July 2 to July 10. Working conditions in the scullery are not satisfactory due to high temperature and humidity; there is a tendency to rush the mess gear through without giving adequate time for thorough sterilization. While at sea, frequent drills and the darkening of the ship at night are further causes for haste in cleaning and stowing of mess gear. The installation of a more modern and satisfactory dish sterilizer has been approved. Much of the mess gear, especially aluminum coffee pots and pitchers, is old and battered, which makes cleaning difficult. Installation of the cafeteria system has been provided for the near future and replacement of old mess gear is being kept at a minimum pending this improvement. At the outbreak of the epidemic, chipping of paint from all bulkheads and overheads throughout the mess compartments was being accomplished. This caused much confusion in the routine of setting up mess tables and difficulty in maintaining the usual state of cleanliness in these spaces.

A leak was discovered in the sewer line from the crew's head, where this line passes across the overhead of No. 3 mess compartment. Temporary repairs had been made on this line pending a tender overhaul period beginning about July 17, but leakage was reported by mess cooks detailed in this compartment at the outbreak of the epidemic. The defective portions of this line were replaced with new installation at the beginning of the tender overhaul and following this the epidemic began to subside. The nature of this leak and its location are considered a possible source from which fecal contamination of mess gear and food may have spread disease.

Inspection of the Ship's Service Store revealed no gross defects in the methods of preparing and serving refreshments. Borden's ice cream mix is used and its preparation is conducted in a sanitary manner. The sale of refreshments was discontinued until a thorough inspection of personnel and equipment was completed. Samples of the ice cream on hand were cultured and found negative for pathogenic bacteria. No sandwiches are sold in the store or elsewhere on board.

Statistical Data

Cases diagnosed as dysentery_____ 95
Cases not diagnosed dysentery but treated ambulatory_____ 50
Total sick days_____ 251
Average sick days per case_____ 3
Duration of epidemic (days)_____ 18

The source of this epidemic was not established conclusively but the defective sewer line and breakdown of the dish sterilizer are considered as the possible causes. Following repairs of the sewer line the epidemic rapidly subsided. Contamination of mess gear and mess cooks' hands from this source would serve to spread infection. Contributory factors such as frequent drills, darkening of ship, necessity for setting second messes due to excess complement, and the chipping of paint work in mess compartments, were considered as tending to disrupt established routine of serving meals.

Gastro-enteritis, acute—U. S. S. *Mount Vernon*—(*Special report dated July 29, 1941*).—What was considered to be a mild epidemic of gastro-enteritis, acute, occurred on the U. S. S. *Mount Vernon* while at sea on the afternoon of July 26, 1941. The noon meal was served to the troop passengers and ship's crew from 1100 until about 1300. The menu consisted of bean soup, boiled sugar cured ham, boiled cabbage, boiled turnips, boiled potatoes, sliced pickles, bread and butter, and coffee.

The first cases reported to the sick bay at about 1430 complaining of severe abdominal cramps which were localized mainly across the upper abdomen. The cramps were accompanied by nausea and vomiting. A few additional cases were admitted between that hour and 1630 when a sudden and marked increase in the number of cases occurred. At this time the patients complained of violent abdominal cramps, vomiting which was almost projectile in character, and retching. They were extremely prostrated. Many collapsed on the deck and were brought into the sick bay on stretchers, but none lost consciousness. Some of the patients suffered from a profuse watery diarrhea, but this symptom was not present in all cases. A small percentage of the patients having diarrhea had bloody stools.

The peak in the number of cases continued until approximately 2100, after which there was a gradual tapering off of admissions. From this hour, a noticeable diminution in the severity of the symptoms was apparent. The patients reported to the sick bay ambulatory and complained only of mild abdominal cramps. By midnight the epidemic had entirely subsided and during the remainder of the night only two mild cases were admitted.

Physical examination failed to show anything unusual, except for tenderness and muscular guarding across the upper abdomen. No elevations of temperature were noted.

An attempt was made to treat the earlier cases with bismuth subnitrate and camphorated tincture of opium, but the patients were unable to retain these preparations. As the more severe cases were admitted, morphine sulphate grain $\frac{1}{8}$ to $\frac{1}{4}$, depending upon the severity of the symptoms, was administered hypodermically and, in most cases, gave the patient prompt relief. Some of the cases required a second dose of $\frac{1}{8}$ grain of morphine to alleviate the symptoms. This was especially the case in those patients who had received only $\frac{1}{8}$ grain of the drug as an initial dose.

A total of 104 cases was admitted, 95 from the Army personnel and 9 from the Navy. It was later learned that an undetermined number of enlisted men suffered from milder symptoms, but did not report for treatment. By the following morning many of the patients had fully recovered, except for some weakness and slight upper abdominal soreness. Seventy-two were therefore discharged from the temporary sick bay. Some of the remaining 32 complained of weakness and occasional vomiting while others had a mild diarrhea. Temperature was normal. By the morning of July 29, all of the remaining patients had been returned to duty.

The positive cause of the epidemic has not as yet been definitely established, but the evidence points strongly toward the boiled ham. The patients were questioned and several of them stated that they had eaten nothing but a ham sandwich at the noon meal. An added piece of evidence is the fact that while no ham was served to the officers' mess (Army and Navy), two Army officers who ate ham sandwiches from the general mess became ill. These two officers were not acutely sick, but suffered from some abdominal distress and discomfort.

The hams were removed from cold storage at noon on July 25, put on to boil at 2200 that night, and were cooked continuously until 0400. The water was changed three times. At 0830 on July 26 slicing of the hams was started and continued until the beginning of the meal at noon. The slices were placed in either aluminum or stainless steel pans which, when filled, were placed in the bake oven or steam table until served.

Just why such a small number of cases should occur when there was a total of 4,975 men on board is difficult to explain. This discrepancy makes it appear that the cases were more of a gastro-enteritis than a true food poisoning, in which case it is logical to assume that a larger

number of those on board would have been affected. However, the patients did present symptoms which were characteristic of food poisoning and it may be that a portion of the ham was spoiled and that the men who became sick partook of this portion.

Samples of the ham and vomitus were forwarded to the United States Naval Medical School, Washington, D. C., for analysis in an effort to determine whether the ham was the cause of the trouble.

Food Infection—U. S. S. Maryland—(Special report dated September 29, 1941).—Thirty-four cases of food infection were noted on September 22, resulting in one admission to the sick list. In each case cold ham sandwiches were found to be the etiological agent.

The sandwiches had been prepared 6 hours before consumption and the ham used had been sampled by the ship's cooks the night before and again in the early morning without ill effects. Although the food was kept in a relatively cool place, no attempt was made to refrigerate it. Culture of remnants of the sandwiches revealed *Staphylococcus aureus*.

Symptoms developed suddenly 4 hours after the meal and consisted of violent nausea, vomiting, moderate prostration, and mild diarrhea. which rapidly became watery. Most cases had abdominal cramps and generalized abdominal tenderness on examination. Physical examination was otherwise essentially negative.

Treatment consisted of emetics, morphine sulfate and bismuth and paregoric for the more severe cases of diarrhea.

The preparation of luncheon foods which are susceptible to contamination has been discontinued aboard this ship if the circumstances do not permit immediate serving.

Food poisoning—Second Battalion, Fifth Marines, First Marine Division, F. M. F., Marine Barracks, Quantico, Va.—(Special report dated August 19, 1941).—On August 6, 1941, at 1930, the personnel of the Second Battalion, Fifth Marines (reinforced), ate the evening meal in the field. The personnel did not eat in company formation but in haphazard formation. No objectionable odor or taste was noted during meal time nor were there any such objections made by any of the personnel. The food was served from the usual containers and prepared in the usual manner.

Two hours after meal time, the first man became sick with the symptoms of nausea, abdominal cramps, chilliness, and headache. Objective signs were vomiting, retching, diarrhea, rapid pulse, increased respiration, and profuse perspiration. The skin was cold and clammy. There was no complaint of metallic taste in the mouth or burning sen-

sation in the stomach. In all instances the personnel complained of marked weakness. Soon after the first patient there was a great influx of sick personnel until 2300. After this time the sick decreased in number until 0300 the next morning. Thirty percent were markedly affected; 50 percent were moderately affected; and 20 percent were slightly affected.

Many of the personnel were relieved of cramps and nausea after vomiting but after 5 to 25 minutes the symptoms and signs returned. Approximately 25 percent had diarrhea. There was no marked thirst noted. The onset of symptoms was rapid in the majority of the cases and in nearly all cases nausea or abdominal cramps was the first symptom. The color, consistency, and contents of the vomitus was difficult to ascertain on account of darkness but samples were obtained and sent back with the evacuating vehicles. It was noted that nearly all of the affected personnel were comparatively newcomers in the Marine Corps.

The possible sources of infection were: (1) No water available for cleaning mess gear after previous meal; (2) food held in containers too long; and (3) contaminated or spoiled ham.

MENTAL AND PHYSICAL QUALIFICATIONS OF RECRUITS

STATISTICS FOR THE QUARTER ENDING SEPTEMBER 30, 1941

The following statistics were taken from sanitary reports submitted by naval training stations.

July, August, and September	United States naval training stations—			
	East	Northeast	Middle West	Southwest
Recruits appearing before a board of medical survey	187	108	106	116
Recruits recommended for discharge from the service	205	66	29	116
Recruits discharged by reason of medical survey	226	(¹)	15	(¹)
Recruits held over pending further observation	113	31	(¹)	0
Recruits transferred to the hospital for treatment, operation, or further observation for conditions existing prior to enlistment	(¹)	46	15	149

¹ Not reported.

The following table was prepared from reports of medical surveys in which disabilities or disease causing the survey were noted existing prior to enlistment. With certain diseases, survey followed enlistment

so rapidly that it would seem that many might have been eliminated in the recruiting office.

Cause of survey	Number of surveys	Cause of survey	Number of surveys
Absence, acquired, teeth	13	Enuresis	83
Accessory, rib	1	Epididymitis, chronic, nonvenereal	1
Adhesions, abdominal	1	Epilepsy	30
Albuminuria	2	Epiphysitis, thoracic vertebra	1
Amblyopia	6	Flat foot	52
Amnesia	1	Foreign body, nontraumatic	1
Amputation, traumatic	2	Fracture, simple	3
Aneurysm, descending, thoracic aorta	1	Gonococcus infection, joint	1
Arthritis, chronic	5	Hammertoe	3
Asthma	6	Hay fever	1
Astigmatism, compound, myopic	2	Headache	1
Astigmatism, simple, myopic	1	Hemorrhoids	1
Atrophy	1	Hernia, inguinal, indirect	26
Bronchitis, chronic	1	Hernia, recurrent, after operation	1
Bursitis, chronic	2	Hernia, umbilical	1
Cardiac arrhythmia, auricular fibrillation	1	Hernia, ventral	2
Cardiac disorder, functional	4	Hydrocele, spermatic cord	1
Caries, teeth	1	Hydrocele, tunica vaginalis	4
Carrier	1	Hyperhidrosis	1
Cataract	2	Hypertension, arterial	5
Chondromalacia	1	Hypertensive heart disease	1
Colitis, chronic	1	Hypertrophy, heart	2
Color blindness	7	Hypochondriasis	4
Conjunctivitis, follicular	1	Hypopituitarism	1
Constitutional psychopathic inferiority, without psychosis	15	Insufficiency, ocular muscle	2
Constitutional psychopathic state, emotional instability	13	intracranial injury	3
		Joint, internal derangement of	3
		Laryngitis, chronic	1
Constitutional psychopathic state, inadequate personality	18	Loose body in joint	1
Constitutional psychopathic state, paranoid personality	1	Lymphadenitis, cervical, tuberculous	1
		Malocclusion, teeth	3
		Mastoiditis, chronic	1
Constitutional psychopathic state, sexual psychopathy	1	Mental deficiency, moron	11
Contracture	2	Migraine	1
Cryptorchidism	3	Myopia	2
Curvature of spine	5	Myositis, chronic	13
Cyst, teratoma, inflamed	1	Nephritis, chronic	24
Cyst, teratoma, quiescent	3	Neurosis	1
Deafness, bilateral	8	Nostalgia	2
Deafness, unilateral	7	Osgood-Schlatter disease	4
Defective physical development	4	Osteochondritis, deformans	4
Deformity, acquired	12	Osteochondritis, dissecans	2
Deformity, congenital	11	Osteochrondroma	1
Dementia praecox	10	Osteoma	1
Deviation, nasal septum	3	Otitis media, chronic	30
Dislocation, articular cartilage	5	Paradentosis	3
Dislocation, vertebra	1	Paranoid state	1
Dislocation, chronic, recurrent	7	Perforated nasal septum	1
Eczema	1	Pes cavus	5
Effort syndrome	3	Phlebitis	1
Endocrinopathy, pituitary	1	Pneumonitis, chronic, nontuberculous	3

Cause of survey	Number of surveys	Cause of survey	Number of surveys
Pneumothorax	1	Synovitis, chronic	2
Psoriasis	1	Syphilis	2
Psychoneurosis, anxiety neurosis	14	Syphilis, seropositive only	2
Psychoneurosis, compulsion neurosis	2	Tachycardia	5
		Trachoma	2
Psychoneurosis, hysteria	27	Tuberculosis, pulmonary, chronic, active	4
Psychoneurosis, neurasthenia	2		
Psychoneurosis, psychastenia	1	Tuberculosis, pulmonary, chronic, arrested	63
Psychoneurosis, situational	12		
Psychoneurosis, traumatic	14	Tuberculosis, pulmonary, miliary, healed	2
Psychoneurosis, unclassified			
Psychosis, manic-depressive	7	Tuberculosis, cervical vertebra, arrested	1
Psychosis, with mental disease	2		
Pterygium	1	Tumor, mixed, activity unknown	2
Retinitis	1	Ulcer, duodenum	7
Rheumatic fever	1	Ulcer, stomach	1
Rhinitis, allergic	1	Ulcer, skin	1
Rupture, traumatic	8	Union of fracture, faulty	8
Sarcoma	1	Urticaria, allergic	1
Sclerosis, disseminated	1	Valvular heart disease, aortic and mitral	3
Seasickness	1		
Sinusitis, ethmoidal	2	Valvular heart disease, mitral insufficiency	31
Sinusitis, frontal	3		
Sinusitis, maxillary	1	Valvular heart disease, mitral stenosis	1
Somnambulism	16		
Spondylolisthesis	1	Valvular heart disease, pulmonic	1
Sprain	1	Varicocele	6
Strabismus	1	Varicose veins	3
Stricture, urethra	2		
Syncope	5	Total	820

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United States
Naval
Medical Bulletin

UNITED STATES
NAVAL
MEDICAL BULLETIN

FOR THE INFORMATION OF
THE MEDICAL DEPARTMENT OF THE NAVY

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DIVISION OF PUBLICATIONS
THE BUREAU OF MEDICINE AND SURGERY

THE MISSION OF THE MEDICAL DEPARTMENT OF THE NAVY

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TO KEEP AS MANY MEN AT AS MANY GUNS AS
MANY DAYS AS POSSIBLE

⚓

Compiled and published under the authority of Naval Appropriation
Act for fiscal year 1943, approved February 7, 1942

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NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

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Volume XXV, 1927, No. 1.
Volume XXVII, 1929, Nos. 3 and 4.
Volume XXVIII, 1930, Nos. 1 and 3.
Volume XXXIII, 1935, No. 3.
Volume XXXIV, 1936, Nos. 1, 2, and 4.
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Volume XXXVI, 1938, No. 1.
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PREFACE

THE UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of appreciation to authors of papers of outstanding merit.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

<div align="right">

Ross T McINTIRE,
Surgeon General, United States Navy.

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The greatest accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible for the editor to understand or verify references, quotations, etc. The frequency of gross errors in orthography in many contributions is conclusive evidence that authors often fail to read over their manuscripts after they have been typewritten.

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LOUIS H. RODDIS, *Editor,*
Captain, Medical Corps, United States Navy.
HILTON W. ROSE, *Assistant Editor,*
Lieutenant Commander, Medical Corps,
United States Naval Reserve.

VIII

SPECIAL ARTICLES

PINTA, A TREPONEMATOSIS [1]

A REVIEW OF LITERATURE

By Captain Richmond C. Holcomb, Medical Corps, United States Navy, retired

A new syphiloid has recently come to light to join that long list which has been accumulating since 1528, when, at a time antedating the invention of the word syphilis, Sárasótt was noted in Iceland. This new syphiloid, widespread in dark-skinned races, is extensively reported in the southern States of Mexico, Colombia, and Venezuela. Recent reports have also come from Brazil, Ecuador, Peru, and the West Indies—particularly Cuba, where the discovery of a treponema was first announced. However, there is an extensive literature on the subject under a host of names, equally as numerous as the names for such diseases as yaws-syphilis, bejel-syphilis, and syphilis among native peoples. The name pinta or mal del pinto for this disease, seems to have originated in Mexico. One of the first writers to use the term pinta was an American doctor, Samuel McClellan (117), in a letter to the American Medical Review and Journal, September 6, 1825. This was one of the earliest of our medical journals, published at a time when American medical experience was finding independent expression. Mexican authors have failed so far to distinctly trace the disease in their country under this name beyond the time of its recognition in Chiapas about the time of the eruption of Jorullo in 1757, the time cited by McClellan (63) (93) (138), and by the priest, Alzate y Ramírez (1). The disease has been described in literature as *lepra* (138); *empeines* (5) (86) (90) (129) (162); *tiña* (10) (28) (76) (109) (174); *enfermedad chiapaneca* (10) *jiricua* and *curicua* (1). A number of other names have appeared in the literature during the nineteenth century, such as *carate*, a common name in Colombia and Venezuela (66) (129) (174) (177); *pannui carate* (Alibert 1829); *lota* in the Guianas (24), (66), (112), (132), the afflicted here at one time being called *"lotards"* or *"leotards"*; in Dutch Guiana it was called *boasie* (132) (134) (158); and it received much attention in French Guiana as *mal rouge de Cayenne* (134), or, among Spaniards

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mal rojo de Cayena (129) (174); *purú-purú in Brazil* (88) (116)
(159) (160) where, according to Martius the indians called those
afflicted *pinipinima-tawüjo*, or the spotted. Silva says the early Castil-
lian colonists called them *hombres overos* or "spotted men." In Hon-
duras and Guatemala it was called *cativa* (4) (66) (104) (129) (174)
(177); *carathes*, used in French texts (8) (9) (50) (53); *taché
endémique des cordillères* (53); *mancha endemica de las Cordilleras*
(129) (174); *mal de Manchas* (76): *overo* (42) (110) (160); *quirica*
or *quriqua* (*curicua*) in Panama (1) (24) (88); *bulpis* (24); *cara,
ccara, kcara or vicara* a name used in Peru (38) (39) (87) (174);
micosis penicillares (37); *enfermedad azul* in Ecuador (110); *bus-
sarolle* in Haiti (129) (153) (174); *guasarola* in Santo Domingo
(129) (153) (174); *pinquette* or *piniuti* in Guadaloupe (129) (153)
(174); *tungere* on the Gold Coast of Africa (18) (129) and, because
of its areas of depigmentation, *porcelana* (Heller 1853), *leucoderma*
(22), *paño blanco* (177), *lepra blanca* (3), *vitiligo* (46) and *leucoderma
syphilitica.*

Like syphilis itself, it was formerly regarded only as an affection
of the skin, but since 1881 it was generally regarded as a cutaneous
mycosis and ascribed to the invasion of the skin by several different
species of fungi, of the genera *Aspergillus, Penicillium, Monila* and
Trichophyton (13) (24) (39) (41) (76) (121) (129). Clinically
it took the name of the colors of the spots: black, white, blue, violet,
red, and yellow (24). It was always described as a chronic dis-
ease, beginning in early life, and lasting 20 years or a lifetime.
The disease appeared on various locations of the skin of the body,
and there is no region of the surface, except the scalp and nails,
where it has not been described and illustrated by photographs.
Manson wrote of pinta that "the palms of the hands and the
soles of the feet are not attacked" (33 loc. cit.). Brault said
the same thing. (J. Brault, *Traité pratique des Maladies des
pays chauds et tropicaux*, 1900), and the same statement is made
by Stitt (165). This cannot apply to recent descriptions of the disease,
for it was in the case of a Negro in Cuba, with chronic keratotic lesions
of the palms and soles, in whom the treponema now generally asserted
to be the cause of the disease, was first discovered (35) (36) (87)
(96) (150) (153). Osborne Browne (18) and other writers such as
Gaucher (50) had previously reported palmar and plantar keratoses
as a symptom of *Carathés*. Gaucher also described lesions of the
mucous membranes of the mouth, tongue, and the male and female
genitals (50). The treponema has now been reported from cases in
Cuba, Mexico, Venezuela, and Ecuador, and has had six different
names proposed for it.

THE DISCOVERY OF THE TREPONEMA

On August 3, 1938, a treponema was discovered in the serum of scrapings of active lesions in a case of pinta in the service of Professor Sáenz at the Hospital de Nuestra Señora de las Mercedes, Havana, Cuba, by Drs. Grau Triana and Alfonso Armenteros. Two days later, Dr. León y Blanco, the pathologist at the hospital, demonstrated in the same case, treponemas in the fluid from enlarged lymph nodes, and subsequently in tissue stained by Levaditi method. These treponemas were morphologically identical with *Treponema pallidum* and *Treponema pertenue* as examined by darkfield under the microscope, and stained by standard methods (64) (88) (127) (153). The finding of the treponema was soon confirmed by others in Cuba, Mexico (31) (64) (88) (89), Venezuela (17) (136), Colombia (136a), and Ecuador (110). It is reported that in Mexico between October 14 and 17, 1938, among 91 pinta patients at Iguala, Mexico, the treponema was demonstrated in 86 cases.

Because of more clinical material, and for other reasons, not the least of which is the enthusiasm of León y Blanco, the investigation has progressed far in Mexico. The discovery of a casual parasite has given rise to six different names for it, coming from France, Cuba, Mexico, and Ecuador. Whether because the parasite in its morphologic characters could not be distinguished from that of syphilis, or for other reason, the delay in giving it a specific name, lost to the Cuban discoverers the opportunity to name the parasite. The priority was lifted by E. Brumpt (20) (172) who, it would appear, already has *Trichophyton carateum* (Brumpt 1913) named for him as a cause for the disease (19). The names now offered are: *Treponema carateum* (Brumpt), described by Brumpt in biopsy material sent to France from Mexico (20); *Treponema herrejoni* (León y Blanco), based largely upon investigations carried on in Cuba and Mexico, and named to honor a distinguished student of the disease in the latter country (89); *Treponema pictor* (Grau-Alfonso), a name proposed by Prof. V. Pardo Castello, to distinguish the Cuban doctors Grau y Triana and José Alfonso Armenteros as the first searchers to reveal the presence of the parasite in the lesions (127); *Treponema americana*, a name proposed in recognition of the work of an investigator in Venezuela (17, 110); and *Treponema discromoderma* (León), a name proposed by an investigator who has described the parasite as found in the lesions of patients in Ecuador (110). Recently the discoverers have added to this list the name *Treponema pintae* (153 b). Eight names for treponemata still believed to be morphologically indistinguishable from each other does not tend to clear the subject of the causal agent.

Before discussing the newer pattern in which the disease is now described, it seems advisable to refer briefly to three other subjects, in addition to the cutaneous lesions, which have had a bearing on the suspicion that the disease was due to a treponema. These are:

1. That the disease reveals the same behavior to serological tests as pertains to the other members of the group of treponematoses, such as syphilis, yaws, and bejel.

2. That, like them, it responds clinically to the same kind of treatment with mercury, arsenicals, and bismuth.

3. It bears a relationship in hereditary or familial transmission to the treponematosis syphilis.

THE SEROLOGICAL REACTION IN PINTA

Although since 1913 the value of antisyphilitic treatment was pointed out by Gratz (67) as a specific for carate, little attention was paid to the matter until 1926. The previous year Peña Chavarría and Shipley had made an exhaustive report on the disease, giving much attention to fungi and two species of *Simulium* as possible vectors (129). However, Dr. Walter Menk of the United Fruit Co., reporting on the Wassermann reaction in association with various diseases encountered in Colombia, found among 67 cases of carate (the name for pinta in this country), that the reaction was positive in 74.5 percent of his cases. Menk (119) then made the observation:

According to general opinion, carate is caused by fungi, and often the presence of fungi in scrapings from the diseased parts of the skin is striking. Nevertheless the high percentage of Wassermann reactions found in this disease caused me to entertain some doubt as to whether fungi which have been found are the primary cause of the various types of carate in our Medical Service at Santa Marta.

About this same time, Dr. Salvador González Herrejón, a professor of skin diseases and syphilis at the University in Mexico, was struck with much the same conclusion. Without a knowledge of Menk's paper, after observing two cases of mal del pinto, in which the positive serological reaction was obtained, and which were diagnosed *pinta* and *syphilis*, a third, also studied, showed much the same features. These facts with other circumstances, such as the .response of the active lesions to antisyphilitic treatment, increased his doubts as to a fungus origin for the disease. The fungus origin of the disease was already questioned in some quarters. His histologic examinations of the affected areas of the skin showed definitely certain phenomena that would result in an altering of the color-picture in these dark-skinned patients, among whom the disease happened. Such changes were alterations in the vascular supply of the skin, and alterations in the pigmentary deposit. In 1927

González Herrejón offered his conclusion from an etiological standpoint, that mal del pinto was a treponematosis related to syphilis and pian (yaws), (57), (84).

Since this time there has been an increasing number of reports of positive serological results in mal del pinto, using such tests as those of Wassermann, Meinicke, Proske, Müller, and Kahn.

In 1927 Dr. J. C. Register performed the Wassermann, Kahn, and Meinicke tests among 287 cases of carate in Colombia. Of 287 who were tested with the Wassermann reactions, 80.6 percent were strongly positive, 4.8 percent lightly positive, 6.7 percent negative, and the remaining doubtful. Among 117 of these tested with the Kahn method, 81.1 percent were strongly positive, 5.6 percent weakly positive, 7.6 percent negative. Among 118 tested by the Meinicke method, 74 percent were strongly positive, 5.4 percent lightly positive, and 11.4 percent negative (107).

In 1931 Drs. Thonnard-Neumann, Camacho-Moya, and K. C. Brewster, B. S., working at the United Fruit Co.'s hospital at Santa Marta, Colombia, made a splendid report on the clinical findings in cases of carate, and in 75 such cases, reported the serology positive in 65, or 90 percent. They reported lumbar puncture positive in 2 of 5 cases, and 80 percent of their cases showed upon roentgen examination, changes in the aorta (167).

The same year, 1931, Latapí, reporting upon the disease, pointed out the response of the disease to antisyphilitic treatment, the usual positive character of the serology, and observed that the Wassermann often failed to become negative until 3 or 4 years after the clinical cure (84).

Dr. Pérez Rodríguez, in 109 cases, found the Wassermann strongly positive in 104, weakly positive in 1, and doubtful in 3 cases (107).

Dr. Vicente Pardo Castello and Juan Grau y Triana in a series of patients in Cuba demonstrated strongly positive reactions (107).

Drs. A. L. Briceño Rossi and David Iriarte have reported their experience with carate in several regions of Venezuela. In the Barinas region, among 161 patients who had been treated for carate, with complete disappearance of the spots ("manchas") for a period of 1 year, 111, or 78 percent, were found to have positive Kahn serological reactions. A nearly same percentage, 77 percent, was observed in a similar type of cases observed in the Quebrada Seca region. On the other hand, among those caratosos who had received no treatment, they reported that the percentage of positives was 100 percent. They observed that similar findings had been made in Mexico and Colombia (16).

A commission for the study of mal del pinto in Mexico, from the Department of Health of Mexico, conducted 130 Wassermann reac-

tions, and reported 125 strongly positive, 3 negative, and 2 cases anti-complementary (107).

Dr. F. León y Blanco reports that in a group of 56 patients in Mexico afflicted in the initial stage of "empeines", 17 of whom had been experimentally inoculated, the results in the Wassermann and Kahn tests in all cases were negative (107). In a more recent paper León y Blanco reported the results of Wassermann and Kahn tests performed in cases of mal del pinto in the secondary stage as follows: Among 94 Wassermanns 81, or 86 percent, were positive. In 107 Kahn tests, 95, or 88 percent, were positive. In 6 cases the Wassermann was negative and the Kahn positive (108).

In 1933, Dr. Howard Fox observed a negress in the leper hospital at Christiansted, Virgin Islands, whom, from the considerable pigmentary lesions with depigmentation and the records of positive Wassermann reactions in 1929 and 1932, he considered a case of pinta. The case was reported in 1939 (47).

From Ecuador, where the disease is called *enfermedad azul*, Dr. Luis A. León states the Wassermann is found positive in 78 percent and the Kahn in 90 percent of his cases (110).

Dr. Ignacio González Guzmán in a recent paper from Mexico, observes that the *Treponema caratem* (Brumpt) presents such a close resemblance to the treponema of Schaudinn and Hoffmann, that a differentiation is difficult so far as concerns its morphologic characters. Furthermore, in a group of twenty patients with late clinical lesions, in all of whom treponema were demonstrated, he found the characters of the new Kahn verification test for syphilis: That is to say, the consistently positive test showing the more marked precipitation at 37° than at 1° C. (54). In a second paper he showed that dilutions (1–5 and 1–20), and also cold (1° C.), reduced the intensity of the reaction (55). In a third paper dealing with the early stage of the disease, known as "pintides" (*vide infra*), the Kahn was always positive, but the Wassermann gave inconsistent reactions, being negative in 30 percent of the cases. In these cases the dilution had a greater influence in decreasing positivity than in the typical cases, whereas cold (1° C.) had a less marked influence on positivity than in the more advanced or typical pinta cases (56).

Drs. Louis Chargin and Charles Rein recently applied the Kahn verification test to 268 cases with pinta. All gave strongly positive reactions to serodiagnostic tests varying from 4 to 160 units with the Kahn quantitative test. Of these, 225 (83.9 percent) gave the syphilitic type of verification reaction, and 17 (6.3 percent) the general biologic (nonsyphilitic) type, and the remaining 26 (9.7 percent) gave inconclusive results. They state that their results parallel those reported by Dr. José J. Escobar, who furnished the blood specimens (25b, 36a).

It is evident from the foregoing citations, that there are strong reasons for investigating the relationship of this disease to syphilis. Furthermore, the reports indicate a higher percent of sensitivity to the Kahn test where other tests have been practiced.

RESPONSE TO ANTISYPHILITIC DRUGS

The therapeutic response to the antisyphilitic drug has been another factor that drew attention to the fact that mal del pinto might be a treponematosis similar to syphilis, yaws, and bejel.

The first writer to call attention to the use of mercury and the arsenicals was Dr. Rafael María Gratz (67) of Chaparral, Colombia, in 1913. He reports two cases of carate, the first in a man who was suffering from tabes dorsalis, with extensive lesions of carate over the body, which cleared up under muscular injections of biniodide of mercury; and the second case was a young woman, age 15, who in addition to the skin lesions of carate, had a chancre on the vulva. The lesions in this latter case cleared up promptly under the administration of "606". No report of a Wassermann was made, but this author tabulates four conclusions:

1. That iodine exerts only a local antiseptic action.
2. That small doses of mercury were followed by good results.
3. That arsenobenzol appeared to be a specific for carate.
4. He recommended the employment of mercury and arsenobenzol as a new treatment for carate.

Little attention seems to have been paid to this paper.

In 1929 an excellent paper on the use of bismuth in mal del pinto appeared from the pen of Dr. Villaneuva Urrutia of Tuxtla Gutiérrez, Chiapas, Mexico (174). This paper refers to the use of the soluble salts of mercury recommended in 1920 by Dr. José Larumbe, potassium iodide and colloidal gold by Francisco Paredes the same year (1920), and of the use of neosalvarsan in 1928 by some of the physicians at the General Hospital at Mexico City, and also (1928) by Dr. Antonio Cachón Ponce in Chiapa de Corzo.

In a recent paper dealing with the subject of the treatment of mal del pinto in Mexico with arsenicals and bismuth since 1920, Dr. Galo Soberón y Parra (162) tells how it was noticed that among workers at the mercury mines at Huitzuo, Guerrero, many workers developed a mercurial stomatitis from breathing the fumes that escaped from the furnaces where the volatile mercury was distilled from the ore; and among those workers affected with the disease mal del pinto, which prevailed extensively in Guerrero, and who suffered from this mercurial stomatitis, many were cured. This was particularly true of the active lesion commonly known as "empeines," the erythemato-squamous dermatosis, designated by León y Blanco as the

initial lesion and also the later "pintides." This observation led to the use of mercury and later, on empiric grounds, to the employment, some 20 years ago, of neosalvarsan and bismuth in this disease (174). The ore, Livingstonite, from which mercury was obtained, was discovered there in 1874.

A casual review of the literature, however, shows that mercury was used quite generally for the disease in Chiapas, before the condition fell into the error of being supposed to be caused solely by a fungus. Berecochea (10), in 1811, stated that a common method for the treatment of the disease in Chiapas was with mercurial frictions, and the internal use of the sublimate. León y Blanco considers this the first reference to treatment with mercury in Mexico. Corona, writing this same year, state that the disease which he calls *tiña* is indigenous to Chiapas and that in the stage of the *empeine* the disease is cleared up with "azogue" (the Arabic name for mercury as commonly used by Ruiz Díaz de Isla in his work on the treatment of syphilis) (72). Corona says he knew many families in Tuxtla who had successfully employed this remedy as a preventive against the ravages of the disease, notwithstanding that they were in daily contact with tiñosas (28). Juan J. León, in 1862, noted that the disease which then prevailed in Tabasco and Chiapas, and which he also called *tiña*, bore some relation to syphilis, not only in the cutaneous manifestations, but likewise in its response to mercury (109), an idea, writes León y Blanco, resurrected by Menk in 1926 after investigation of its serology; and to which I may add, upon clinical grounds was pointed out 13 years earlier by Gratz (67).

THE CLINICAL RELATIONSHIP OF VITILIGO TO SYPHILIS

The relationship of depigmentation, now called vitiligo, to syphilis, has recently had a growing attention. Crouzon and Foix (30) in 1914 presented two cases: The first case, that of a girl aged 19, presenting vitiligo and the stigmata of congenital syphilis; the second case, the mother of this same girl, aged 48, who was afflicted with tabes dorsalis. The authors cited other cases in the service of M. Pierre Marie and M. Guillain, wherein we find the same suggestion.

In 1921, Dr. John E. Lane presented a review of the literature, beginning with the comment of Leloir (1881) that vitiligo was a frequent occurrence in tabetics. From the reports, he collected 83 cases of vitiligo, 38.5 percent of whom were clinically syphilitic, and in 13.2 percent of whom there seemed to be revealed a hereditary element (82).

The exhaustive work of Lacapère on syphilis among the Arabs in North Africa, is a classic work on the relationship of syphilis and vitiligo (81) and has thrown considerable light on syphilis as a life-long disease among unprotected peoples.

A recent paper (January 1942) recites the good results from intra-muscular injections of bismuth salicylate, among 124 vitiligo patients (61 white, 51 Mexican, 11 Negro, 1 Chinese) in Los Angeles, Calif., and describes certain constitutional findings. This author offers the opinion that "congenital syphilis is the possible main pathological factor of an endocrine involvement." This paper, particularly as it deals with the cases of the Mexicans, bears an important relationship to the findings in pinta. The author reports that 7 of 16 patients with vitiligo from the time of birth, had strongly positive blood serology. Nine parents of different families, five mothers and four fathers—two of them with tabes dorsalis—had a strongly positive serology (113).

THE TREPONEMA

The parasite has been described by several writers, who agree in the essential characters of its morphology and its presence in active lesions. We take our description of it from León y Blanco which is based on 1,214 observations (89). The treponema has been found in the serum of the keratotic lesions, in biopsy material from the skin, and, particularly, in the erythemato-squamous lesions, commonly called "empeines" or "jiotes" in Mexico. León y Blanco reports that the treponema may always be found in this lesion, he having observed it 254 times in 254 cases examined. The disease, according to this investigator, "can be transmitted experimentally from person to person, using virulent material proceeding from any clinical type of lesion, no matter in which stage of the disease the sample of infectious lymph might be gathered." This infective material, deposited on light scratchings made on the skin, reproduces the initial lesions of mal del pinto.

The treponema varies greatly in length, between 7.8μ to 36.8μ; it has been calculated an average value of 17.8μ from 500 measurements, and as commonly ranging in length from 12μ to 18μ. This treponema is from 0.25μ to 0.30μ in thickness and its spirals are from 0.8μ to 1μ in depth, measuring the size of each interval of the screw 1μ. The number of spirals changes accordingly to the length of the particular specimen observed. (González Herrejón gives the number of spirals ranging from 5 to 9; L. A. Leon, in Ecuador, reports 12 to 16.)

By darkfield examination it looks like a cylindrical filament rolled up around a fictitious longitudinal axis in the form of a helix or screw, the spirals of which being very regular and close. Such spirals appear rigid at rest, but they contract and relax constantly along the longitudinal axis of the screw whenever the germ moves. The ends are sharp-pointed.

The motility of *Treponema herrejoni* holds a very close resemblance with the motility of *Treponema pallidum*, showing as high a rate as that of the latter.

It turns rapidly around its longitudinal axis and may exhibit an O, P, or S shape after bending itself by distortion or flexion movements. Undulating or creeping movements are not infrequently shown by the whole body of the parasite.

It is readily stained by silver impregnation methods advised for staining spirochetes in smear preparations, as well as by Giemsa's stain, carbolfuchsin and gentian violet, after picric acid, tannin, or potassium permanganate has acted upon the smear.

A 10-percent solution of saponin dissolves these treponemata in 6 hours at room temperature; the same result is obtained either by sodium taurocholate or bile. Distilled water causes them to swell.

We have not succeeded yet in cultivating the new germ, and the suitable animal for inoculation still remains undiscovered (89).

Other writers have added little to the above, other than to state that the treponemata usually occur singly, but may be seen joined end to end. They lose their motility, according to Herrejon, in from ½ to 2 hours at room temperature, and, according to the latter, there are no morphological differences between these treponemas and those which cause syphilis (64). The treponemata as found in Ecuador are reported as from 6 to 20 μ in length with from 6 to 14 spirals (110). The treponema first observed in Venezuela is reported to be 15 to 18 μ in length with from 12 to 16 spirals, slow of movement, but whip-like when in its movement it encounters some obstacle (17). A confirmatory report by the Venezuelan Commission of the National Institute of Health (136) report that the organism observed by them was more or less rigid, with regular, narrow spirals (12 to 15 μ wide), and its motility decreased about 20 minutes after the specimen was taken. With Giemsa or Fontana stain, it was very similar to *Treponema pallidum* and *Treponema pertenue*. Inoculation in guinea pigs, rabbits, and rats was negative.

Fox, who has made a careful study of pinta or carate has published several papers on his personal observations and investigations of this disease. One of his papers (43) dealing with carate in Colombia, in addition to photographs of seven striking cases, also publishes three splendid photomicrographs of the histologic skin changes in stippled and diffuse blue carate and one of a completely depigmentated area. He did not note micro organisms in any of his cases.

R. Gómez Farías (52) has recently published four photomicrographs of cases observed in Mexico City. Here, too, no organisms are in evidence. Saenz *et al.* (153b) have published photomicrographs showing the organism in tissue.

THE ENDEMIOLOGY OF PINTA

The importance of this disease among the dark-skinned people of the near-by tropical or subtropical zones may be realized from various

recent estimates that have been given for three countries directly south of us, the area of the earliest Spanish settlements comprising "New Spain." Here the disease is reported principally among Negroes, native Indians, and half-breeds. Cases have been reported rarely among whites (8, 49). It has long been reported among blacks and natives in tropics or subtropics who live at a low level of subsistence and sanitation. Descriptions of the disease is not limited to the Western Hemisphere, for cases which ought not to be ignored have been reported from the east and west coasts of Africa, among Negroes; among Arabs in Egypt, Tunisia, Algeria, Morocco, and Iraq; and among the dark-skinned races of India, Straits Settlement, and even the Philippines.

According to G. Herrejón (64) it is of frequent occurrence in Colombia where he estimates 600,000 cases; Iriarte (75) estimates 400,000 cases. In Mexico, G. Herrejón estimates 300,000 cases and in Venezuela, Iriarte (75) estimates 55,000. We have no estimates for Brazil, Ecuador, Cuba, and the smaller countries of Central America, lying between Colombia and Mexico. Half of the total of the above estimate would be formidable enough to command and deserve medical interest.

A NEW PATTERN: PRIMARY, SECONDARY, AND TERTIARY STAGES

Dr. León y Blanco has recently cast the pattern of the disease in three stages, a pattern formerly employed for syphilis when it was classified mainly a skin disease. This suggests the same questions which arose to Jonathan Hutchinson when he was asked to prepare an introduction for Numa Rat's valuable monograph on yaws, which described yaws, like syphilis, as a disease of three stages. Hutchinson wrote a foreword for this book which was of unique character, for it was an extended critique which pointed out that yaws and syphilis were, clinically, identical diseases. The two morphologically indistinguishable parasites, differing only in name, now believed causal agents of these diseases, had not been discovered up to this time.

To quote now from a summary of one of the several very interesting and informative papers of León y Blanco (91):

1. Mal del pinto (pinta, carate) progresses through three distinct stages each showing different clinical, serological, and immunological characters.

(a) *The primary stage* begins at the very moment of infection and lasts the period of time the lesion remains alone. Such period varies from individual to individual, being between 5 months and 1 year, or perhaps more.

Clinically, the primary or initial stage is characterized by the development of a papule at the point of infection, after an incubation time of 7 to 20 days. This papule gradually becomes an erythemato-squamous patch, variable in outline and size within 30 to 50 days. During its long-lasting evolution it spreads slowly around the affected area, or other

papules begin to appear peripherally, which in turn increase, and with similar erythemato-squamous patches coalesce with the initial one.

The appearance of these erythemato-squamous lesions varies greatly from one patient to another, as well as in the same individual, according to the developmental stage of the ill condition. The types more frequently observed are the trichophytoid, psoriasiform, lichenoid, and large patches of variable morphology.

(b) The *secondary stage* is characterized by skin rashes or papules, which rapidly change with diversely outlined erythemato-squamous lesions and for which we have proposed the name "pintids." This stage is reached after 5 to 12 or more months have elapsed from the date of infection. The initial lesion keeps on evolving during the secondary stage and becomes indistinguishable from the pintids.

(c) *Tertiary or discromic stage* shows acromic or pigmentary spots, erythema, folicular keratosis, keratoderma and superficial atrophoderma. Cuban, Colombian, and American investigators have reported aortitis and pathological disturbances of the heart sounds; Mexican authors have also reported vago-sympathetic disturbances as well as lymph-node swellings generalized to the superficial nodules.

2. The serological tests advised for the diagnosis of syphilis yield constantly negative results while the initial lesion remains alone, i. e., during the *first stage* of the disease. Besides, superinfection is always possible during this stage.

(a) The *secondary stage* yields approximately 60 percent positive tests; the longer the disease has progressed, the higher the percentage of positive tests obtained. Eosinophilia and an increase of basophil leukocytes are apparent in a high percentage of cases.

After the figures of some authors, 70, 80, 90, or 100 percent of cases yield positive serological tests during the tertiary stage. Experimental superinfection cannot be obtained at this stage.

3. *Treponema herrejoni* can always be demonstrated in the initial lesion, though sometimes it is difficult to do so. Within the initial lesion treponemata are found between the cells of the dermal infiltration and also lying in the intercellular spaces of the malpighian layer.

4. From the histological standpoint the initial lesion constitutes a dermo-epidemic papule with the following outstanding lesions: Discrete keratosis, acanthosis, intercellular edema showing small areas of spongiosis, exocytosis, and necrosis by fusion of isolated cells of the malpighian layer. The dermis exhibits a very dense infiltration containing lymphocytes, plasmocytes and scanty neutrophils and eosinophils; melanophores and histiocytes are also present. This infiltration invades the papillar and reticular portions of the dermis and penetrates the deep portion of the dermis in the form of diffuse cellular spreading.

The hair follicles and the coiled portion of the sweat glands are surrounded by sheaths of cells of the inflammatory infiltration.

Just as in other inflammatory skin conditions, the pigmentary function is affected in mal del pinto, and scanty pigment granules may be seen inside the cells of the stratum germinativum. These pigment granules are also present in other cells of the malpighian layer and in the melanophores of the dermis.

The infiltration encloses a few elastic fibers; such fibers exist in normal quantity in the rest of the dermis (91).

There are two other papers of unusual value and interest dealing with the evolution of the primary lesion: the first by León y Blanco (104), and the second by this author, jointly with Latapi (86). Both papers are splendidly illustrated (the first by 9 figures, the second by 37) which illustrate the evolution of the primary papule through 5 types to the erythemato-squamous lesion to which the name "pintids" is applied.

González Herrejón states that the primary lesion is the only evidence for from 3 to 9 months, then oval macules appear, and several months later a new crop appears. Those lesions that appear after the experimental inoculation, resemble "ringworm" with slightly raised edges. Most of those with lesions of long standing, show general glandular enlargement, enlarged spleen, and positive Wassermann. He states (perhaps on the evidence of León y Blanco *vide infra*), that patients with syphilis contract pinta, and those with pinta contract syphilis. However the causal treponemata have not been morphologically differentiated (64).

León y Blanco conducted a clinical investigation and questionnaire among a total of 1,013 mal del pinto patients in regions of the State of Guerrero (Mexico). Those who acknowledged having had *empeines* before the development of the spots, amounted to 613, or 63 percent; those who denied having had them amounted to 257, or 25 percent; and those who did not know whether they had ever had them or not, amounted to 124, or 12 percent. To account for the number (37 percent) who were unable to give the history of the initial lesion in the form of the *empeine*, he believes that owing to the long and chronic character, some of these had forgotten, or not observed, or misinterpreted the character of the initial lesion (90). No comments are made on the possible hereditary character of those who failed to give a history of the initial lesion.

Most of these valuable observations of León y Blanco, are confined to a description of the skin lesion. The disease is, however, shown to be a constitutional disease with blood changes, a stage of inoculation resistance developing in the course of time. How long this inoculation resistance lasts is not apparent. It must not be forgotten that it is a disease extremely chronic in character, and hidden lesions may be developing over a long period.

During the third stage described by León y Blanco, certain authors in Cuba, Colombia, and Venezuela are reporting such conditions as aortitis and pathologic murmurs of the heart. León y Blanco, in this connection, refers to the work of V. Pardo Castello and J. Grau Triana in Cuba, and the work of Thonard-Neumann, Camacho-Moya and Brewster (167) already referred to, who found 80 percent of 75 cases of carate to have aortic changes with positive serology.

Pardo Castello has demonstrated that in 75 patients sick with mal del pinto, 8 percent of them presented dilatation of the aorta, and 50 percent pathological changes in the heart sounds. Sáenz *et al* (153) report cardio-vascular lesions present in 23.3 percent of cases, and changes in the spinal fluid in two of twelve examined for luetic curve. Briceño Rossi and Iriarte among the sick they very carefully examined, picked out 4 who showed clinical signs of aortitis; these were further examined with roentgen ray and their suspicions confirmed in 2 of them. They state further that 40 percent of those who had cardio-vascular alterations denied previous syphilis (16). A recent report by Lurie (113) showing hereditary and constitutional symptoms among Mexicans with vitiligo and hyperpigmentation, bears some relationship to these findings.

Some very important studies of pinta were made in Mexico before the discovery of the parasite, by a special commission under the leadership of Dr. Jesús González Urueña (32). The disease prevailed most extensively in 14 of the southern States, the most intense endemic region being in Guerrero, 23.67 percent of the population being affected. Some 270,685 cases were reported among an estimated population of 2,500,000. The character of the prevailing types were classified as follows: Blue type 67,380; white 57,277; mixed 51,731; lead colored 27,281; with scattered reports of lesser number for violet, black, red, and yellow. Some observers doubt the existence of a yellow variety, such as described with other varieties during the Middle Ages by the Four Masters and Theodoric. However, this commission reported about 7,000 cases of the yellow type. A yellow type is also reported by Villanueva Urrutia (174). Scaling was reported in about one-third of the cases, and itching in about one-fourth (32) (44) (75). The commission made no mention of mycologic examinations as it was generally considered in Mexico at this time that fungi played no part as a causal agent, being, if and when present, of a nature of contaminates upon the surface of the skin, found equally among the noninfected. This may be one reason why not only lesions of the skin were considered, but also affections of the mucous membranes which were reported in 72,873 cases. At the time when the disease was regarded solely as a skin disease, little mention was made of them. The question of heredity, a view advanced by J. J. León, Chassin, Iturbide and others, was suggested in 30,227 of the commission's cases. Heredity in connection with vitiligo is also suggested by others (30) (82) (113).

Dr. León y Blanco believes that the primary lesion of mal del pinto differs from that of syphilis and yaws because it never gets ulcerated. He does not consider the open lesion of cracks and fissures in keratotic lesions of the palms and soles to be ulcerations,

and has recovered *Treponema herrejoni* from them in 29 out of 41 cases. In one of his papers he reports that the sweat of pinta patients may contain virulent treponemata. The infectiousness of sweat, a common observation in connection with leprosy of the Middle Ages, finds a strange companion in pinta. As for ulceration there is no evidence to show that the treponema of yaws and syphilis are pus-forming organisms for they are consistently found in the internal organs of man without any evidence of pus formation. There are several writers on the subject of pinta who have described "ulceration." We find such a description in the work of J. J. León whose text is referred to by Reyes as possessing a rare merit of originality, and who referring to ulceration is quoted as follows: "a period of ulceration never exists in white tiña; with the blue it occurs in a few cases; in many of the red variety the ulceration may be constant and considerable" (109). His description of the virulent or infectious character of the thin serum-like pus is quoted elsewhere. External infection with ulceration, a common hazard in such life-long conditions has been shown to be due to pyogenic contamination. Contamination by fungi and stink saprophytes also occurs. León y Blanco (105) believes that a pinta patient may contract syphilis and a patient with syphilis may contract pinta. To substantiate this he reports two experiences as follows:

An individual who 3 years previously had a syphilitic chancre, and had been treated with a course of neosalvarsan, and whose blood at the time was serologically positive (3 plus by Wassermann, Kahn, and Müller tests), was inoculated intradermally with virulent pinta material. After a period of 20 days the patient developed a typical pinta papule, with treponemata demonstrable by darkfield examination.

Another observation was made in the two cases who developed syphilitic chancres, containing treponemata. These chancres appeared while they were already in an active stage of the blue spots; these spots also contained abundant treponemata.

In this same paper it is interesting to note that treponemata were found in the sweat, and also that it was possible to reinfect, or superinfect a pinta patient during the "secondary stage", but that in recently treated cases no infection takes place. No data is furnished as to how the treponema of syphilis may be distinguished from that of pinta, but the difference such as is offered is based on the clinical character and evolution of the lesion (105). If the causal agent in both cases is identical morphologically this conclusion appears debatable. A lesion similar to the *empeines* has been frequently seen and photographed in syphilis, yaws and bejel, but it is not described as the sole initial lesion as reported by León y Blanco

from the experimental skin inoculation in Mexico. These inocula-
tions represent an infection of the skin, not the mucous membrane
which it is assumed may not be .inoculation resistent. The *empeine*
has since 1539 been reported in medical literature as infective and
producing syphilis as we will show later. Osler long ago com-
mented on a difference between genital and extragenital chancres,
and quotes Colles who had stated that early in his life he thought
he could recognize the initial chancre, "but I am now convinced that
a primary venereal ulcer may begin in any possible form of
ulcer." (23 *loc. cit.*).

The experimental inoculation of 17 cases by León y Blanco was
repeated by J. Gómez Farías (52) in Mexico City who inoculated
two males aged 22 and 16 years respectively. In the second case
the lesions following the inoculation were profusely generalized and
cleared up after 2 months treatment with arsenicals.

<center>A POSSIBLE VECTOR</center>

As for a method of spread, this has been studied recently from
the standpoint of an insect vector. This idea is not new, for Mon-
toya considered a fungus might be carried by this means. Drs. Gon-
zález Herrejón and Ortiz Lombardino (62) have studied the common
blood-sucking insect *Simulium haematopotum* in a region where
pinta is endemic and found treponemata morphologically identical
with those found in the patients serum in 4 out of 48 insects. More
recently León y Blanco (101) has fed the fly *Moscas hippelates* with
serum containing *Treponema herrejoni*, and then transferred them
immediately to feed upon excoriations of the skin of a volunteer, and
he claims in this manner to have successfully transmitted mal del
pinto.

The subject of the fly as a vector for treponematosis has come
up many times in the past 175 years. Edward Bancroft (7) writing
of the character of the treponematosis yaws among the Negroes of
Guiana in South America in 1766, said that it was generally be-
lieved that, among other ways, it was spread through the medium
of flies. "Whites are rarely infected, but the backs of Negroes being
often raw by whipping and suffered to remain naked, they scarce
escape it" (p. 380). In 1803 Thomas Winterbottom also referred
to the spread of this treponematosis by the fly. John Williamson
(176), in 1817, writing of yaws as observed in the West Indies, states:
"It may be transmitted to African or Creole Negroes by flies * * *
A few instances have come to my attention, where whites have been
infected by sexual intercourse." A considerable number of the early
writers on yaws in the Caribbean basin observed that yaws was
transmitted to whites through sexual exposure. Joseph Jones (80)

quotes Dr. Wright of Jamaica, who says: "Yaws is usually propagated by small flies, which alight on ulcers of the hitherto uninfected" (p. 1194). Several United States naval medical officers, Wilson and Mathis, Hunt, and Johnson, have made similar observations (23 *loc. cit.*). In 1936, Kumm and Turner, working in Jamaica, reported the transmission of yaws treponemata to rabbits by the fly *Moscas hippelates*. Thus the fly has long been considered one of the factors in the spread of a treponematosis.

In Colombia a biting insect has long been considered to be a possible vector for carate (129). The same is true in Mexico. The Mexican Commission, 1929–31 (32), under the leadership of Dr. J. González Urueña, reported that in answer to questions as to the probable cause of the disease, in 49,531 cases it was attributed to contagion; 30,227 considered the disease hereditary; and 17,602 considered the bite of an insect was the cause. Iriarte (75) in considering a possible manner that the disease was transmitted in Colombia. quoting also Montoya (121), Peña Chavarría, and Shipley (129), the flies illustrated (fig. 3), designated a biting insect of the genus *Simulium* as the probable vector, and he exhibited figures of it to illustrate his text (75, fig. 8). In this connection it seems pertinent to refer to the early text of J. J. León (109), which is marked with original observations:

Below the scales which cover the spots, a thin liquid pus is formed which could be nothing else than the organic substance of a humor that has undergone isometric catalysis, a modification by which it has acquired the property of transmitting this modification to other organic substances.

And, adds Alicia Reyes (137), to this statement made in 1862, the vector to transmit this virus could be a mosquito or gnat who, when biting, injects the virus.

León y Blanco also found the treponemata of pinta in bedbugs (*Cimex lectularius*).

As a transmitter of the nonvenereal form of the treponematoses yaws, syphilis, bejel, and pinta, the fly and the biting insect have not been without their accusers.

THE ANTIQUITY OF LITERATURE ON HYPERPIGMENTATION AND DEPIGMENTATION (VITILIGO OR LEUCODERMA)

Medicine is an ancient science. The new enlightenment on pinta, is a close-up, as it were, of its present pattern, but its real history, like the history of medicine from which it is inseparable, extends into remote antiquity. Our understanding of the symptom complex of the modern pattern has an evolutionary perspective. To view this perspective we must examine the past and bring it into our mental vision. The farther we venture into the past, the more we detach

ourselves from both the help of exact modern science and the prevailing theories of causation. We know pinta is a lifelong disease. What we see of it at a given time is but an ephemeral stage. Should we depend entirely upon our findings over what is but a comparatively short period of observation, our understanding is cramped, and we suffer a professional myopia. An acute disease such as scarlet fever, smallpox, typhoid, etc., develops quickly, and in a short time most of the pattern of development is before us. This is not so of the treponematoses like pinta, syphilis, yaws, or bejel which last a lifetime. The lifetime of a rat is short, and we can observe certain lifetime effects in him, and interpret them without benefit of anything but acuity of observation, for its subjective symptoms are hidden from us. But the lifetime of the individual is equal to the span of our own life. For this and other reasons it has never been safe to say that some condition, organic affection, or even the invasion of contaminants, does not occur in a lifelong infection like the treponematoses. Those authorities who have done this have retarded rather than advanced progress in our understanding. For instance, the able John Hunter, declaring the blood in venereal disease was not infective, retarded our understanding of congenital syphilis, which he claimed was nonexistent. In certain stages they are more readily communicated than in others. If they were equally infectious at all times, or if all possibility of relapse could be eliminated, they would be easier to understand. In certain stages of the time element they are more readily transmitted to offspring, and the florid congenital syphilis is less frequently observed among native peoples infected during childhood. Sometimes, and in some regions, they are predominantly venereal, and in some regions they are not. Is this because a virulent discharge is more selective for race, place, climate, or selective for skin more than mucous membrane, perhaps through means of some vector, or ignorance in sanitation? How much more simple it would be if we could believe Fernel's law that syphilis, for instance, is always venereal—a *lues venerea.* All these things, and much more with regard to the time element in the disease is well known to every earnest student of it. The experience of one man, no matter how brilliant and how great his opportunity, the annals of the ages have proved, is not enough. In the words of Hippocrates: "Life is short, Art is long, the occasion fleeting, experience fallacious, and judgment difficult."

Among the most ancient descriptions of disease in dark-skinned races are descriptions of the hyperpigmentation causing black stains, spots or blemishes of the skin, and the spots of depigmentation, which even among races where snow is a rarity, are described in their literature as being "as white as snow." These descriptions

usually characterized the disease as communicable, descending even unto the third and fourth generation, and incurable. Treatment was abandoned, and those afflicted became outcasts. Such is a description of the disease in the most ancient medical texts of the Hindu, Greek, Arabian, and Latin writers. These descriptions are continued into the early medical texts of the Romance languages.

The earliest medical description of such disease is that of Celsus (25) (fl. A. D. 14–37) who described three species of pigmentary disturbance under the name *vitiligo*. These species were a white variety called *alphos*, which consisted of whitish scaly spots. A black variety called *melas*, resembling a shadow, and a more deeply situated white variety which was called *leuce*. Whether any one of these varieties might be curable could be determined by pricking the superficial skin with a needle and if serum should flow it was incurable and no attempt should be made to treat it. This test, which reveals the keratotic character of the lesion, is the pathognomonic sign of the hopelessness of the disease. These diseases can be traced through the Greek texts with much the same description down to the time of Actuarius (d. 1283), the last of the Byzantine Greek medical writers. The *leuce*, which is mentioned by Hippocrates, but not described, was considered by him with *lepra* and *lichen*, to be among the most fatal of diseases, beginning often in childhood and lasting for a long time.

The Arabs of the eastern Caliphate described the white and the black variety of pigmentary disturbances under a variety of names transliterated as *algada, alquada, albohak, baras, albaras*, etc. *Albaras* was usually described as a white and black variety, and as in the Greek texts, here again the method of determining whether or not the disease was curable (or lifelong) was solved by pricking the superficial skin, and if only serum was obtained the disease was incurable. There was also a tendency to consider the disease communicable and as allied to leprosy, and it was so classified by the Persian Haly Abbas (d. 994) and also by the Latin surgeons of the Middle Ages. *Albaras* was described as leprosy in the skin, not in the flesh.

In the western Caliphate we find the disease described in three varieties, namely, the red, black, and white. Thus it is described by Ibn al Jazzah (d. 1009) of Tunisia. The Spanish Arab Alzaharavius (d. 1013), also known as Albucasis, has left a long account of the disease, describing a reddish earth-colored variety, a black, and a white variety. Each of these three varieties was subdivided into two species. The cause of the color of the spots was attributed to multiple areas of thick, stagnated humors; these humors being, respectively, the red sanguinous, the black melancholic from the black bile, and the white due to stagnated thick white phlegmatic humor.

This was all very plausible to the prevailing theory of what then constituted the essential humors, and was accepted as readily as the fungus theory amid the wisdom of more modern time. Alzaharavius was one of the first to attribute the disease to both a hereditary and venereal cause. In his chapter on leprosy, he says that *albaras* results from conception the fourth day of menstruation, and it was transmitted from leprous parents. Like the Greeks, these writers gave the disease the test of pricking the superficial skin. If serum should flow, it was a lifelong disease, incurable.

The earliest of the Salernitan School, such as Petrocellus (c. 1035), described the disease under the names *maculas nigras* and *maculas albas*. The former, the black variety, he identifies with *alphos meletos*, and the latter, the white variety, with *alphas leucos* of the Greeks. He gives the same prick test, described by Celsus 1,000 years earlier, to determine if the disease was incurable. Bartholomaeus of Salerno (eleventh century) introduced the name *morfea* for the disease and described a red, black, and white variety, with the same test to determine whether it was curable.

When Constantine Africanus (cir. 1020–1087) made his translations from the Arabic texts, an event to infuse new life into Latin medicine, he introduced the terms white and black *morphea*, which is the name under which it is described throughout the balance of the Middle Ages. From Roger to John de Vigo (1458–1525) one will find the test of pricking the skin as the way to determine whether or not it is curable or not curable. The latter, who unlike his predecessors devotes no chapter to leprosy, classified *albaras* as one of the dermatoses of *morbus gallicus* (the French disease, syphilis). The Arabic and the Latin writers all described it as a communicable disease, and one of the early signs of "confirmed" leprosy. After the time of Avicenna (980–1037), it was a common statement that *albaras-morphea* was a leprosy of the skin, and the "confirmed" leprosy was leprosy of the flesh. Bernard de Gordon (1308) who describes leprosy as a venereal and congenital disease, says that it is well known that *morphea* and leprosy result from the same causes. The Four Masters (c. 1260), in addition to the black and white variety of *morphea*, describe a yellow variety which they attribute to a disturbance in the gallbladder, the same source as the more diffuse icterus. Their account is rather long and better than that of Roger or Rolando. Theodoric (1205–1298) also described a yellow or saffron colored variety (*citrini vel corocei coloris*). Mesue III describes three varieties as the livid, black, and white; William of Salicet (1210–1280) a red, black, and white form of the disease. Lanfranc (1296) wrote a long critical chapter dealing with *morphea*, an attack upon the confused prevailing humoral theories of origin as applied to the general subject of dermatology, and

giving rise to confusion in nomenclature. This chapter, the writings of Henri de Mondeville (1320), and the critical review of dermatology by Leonicenus (1497) who introduced the term *morbum gallicum*, laid the foundations for a new conception of venereal disease, as well as for epidemic eruptive fevers. Valescus of Taranta (cir. 1420) revived the term *vitiligo* for the disease as described by Celsus, almost 1,500 years earlier. *Alba vitiligine* was due to *salsa pituita* (salt phlegm), the *nigra vitiligine* was due to melancholia (black bile), and *rubra vitiligine* was due to the sanguinous humor. He gives the needle prick test, but warns that all vitiligo is difficult to cure and a rash promise should not be made.

For more than 1,500 years the term *vitiligo* had not been limited to the white depigmentation assigned to it for the past 150 years. It included any change in the color of the skin, as cited above.

A form of white leprosy, *kilasa* was long ago reported among the Hindoos by Charaka, whose medical text the eastern Arabic writers Rhazis, Avicenna, and Serapion quote in their texts. Charaka described three varieties, *darana, charana, and citra*. The disease being described as first of a reddish color, then developing an old copper color, and this was succeeded by a whitish variety.

Reports of the disease in India under the modern name *pinta* have recently appeared. Dr. P. G. Edgar (33) who reports a case under this name with excellent photographs, said it was fairly common among the Malays who call it *sopah* in the Straights Settlement. Buchanan (22) commenting on this case from his station in India, did not believe it to be a case of pinta because the photographs showed only black and white spots, whereas pinta also had red and blue spots. The condition had been developing since childhood, over a period of more than 30 years, and it would appear that Buchanan expected all these variously colored spots to be present at the same time. He adds that cases similar to that reported by Edgar are by no means uncommon in India. A similar prevalence is noted by Leslie (111) and by Fernando (40). Fox (45) has questioned the correctness of the diagnosis of pinta in this latter case, reported from Ceylon, where the treponema of yaws was first observed. Woolley (177) has reported it in the Philippines.

The disease has been in recent years described as pinta on the east (12), west (18) and north (81, 114, 155) coasts of Africa. Osborne Browne (18), who had previously served at Honduras, and was familiar with the disease there, says the natives of the Gold Coast, where pinta prevails, attribute it to an antecedent yaws, and about Kano, where the disease is endemic, it is commonly called *tungere* (18, 129). Since the splendid work of Georges Lacapère (81) dealing with syphilis as seen among the Arabs of Morocco, Algeria, and Tunisia, these vitiligines have come to be regarded as a lesion of

syphilis. We have already noted the description of Ibn al Jazzah from Tunisia, the tenth century. Lacapère describes the vitiligo as the same condition that Gardineau in 1842 described as leprosy and that in 1862 was described by Arnould as *lepre kabyle* (pp. 223–232).

Among his plates are lesions similar to the lesion of the neck seen in "ringworm yaws" and pinta in this same location (Planche Vii: *Syphilis secondo-tertiaire papulo-squameuse circinée à centrc pigmenté*). From Iraq, the region formerly described as Mesopotamia, from where Rhazis, Haly Abbas, Avicenna, and Serapion drew their descriptions, Dr. E. H. Hudson has described the treponematosis *bejel*. Among an interesting collection of photographs of his bejel patients which he brought back from Iraq and which he permitted me to examine several years ago, I noted these pintalike lesions in his photographs numbered 25, 54, 63, 66, and 74; and in one case, 72, showing fufuraceous lesions, he had appended the note that in this case he had observed "literally hundreds of treponemata." A pintalike disease among the Arabs of Syria, Arabia, and Egypt was noted in 1846 by Pruner (133). Recently, an investigation of the treponematoses of this region by a special consultant employed by the United States Public Health Service, reported this disease, prevailing under many names among the Arabs, to be syphilis (69), which confirms Dr. Hudson's opinion of the disease (23 *loc. cit.*, 74).

THE IMPORTATION OF THE TREPONEMATOSIS FROM AFRICA TO THE WEST INDIES

From the earliest history of the West Indies we have accounts, free from ambiguity, of the importation of such diseases as venereal leprosy, syphilis, and yaws from Europe and from Africa to America. In the history of the conquest of Mexico by Bernal Díaz del Castillo (1492–1581), who accompanied Cortez in the conquest of Mexico, we have evidence that several of the conquistadores, mentioned by name, were already infected with bubas (syphilis) when they arrived in Mexico (11). The earliest French and English accounts of the disease among the natives of the regions of the Caribbean basin describe the treponematosis yaws as a disease peculiar to the Negro and existing among slaves at the time of importation from Africa. The first mention of the word yaws seems to be in the correspondence between Thomas Sydenham and H. Paman, February 1680. Sydenham (166) writes:

As far as I can learn, this disease, which so frequently attacks these miserable people (slaves which are newly brought from Guinea, even before they land, and likewise those that live there) does not at all differ from what we call the *venereal disease* * * * though it goes under a very different name, for they entitle it yaws.

Hans Sloane (163) gives one of the earliest first-hand descriptions of the disease among the West Indian negroes. Among the syphiloids described in the Caribbean basin was also the disease known to the French as *mal rouge de Cayenne* (6), and known in Surinam as *boasi* (132, 134, 158). The disease under the former name excited considerable attention in France because of its communicable character, and a Commission of the Royal Society of Medicine was formed in 1784 to consider a means of stamping it out (134). The disease which started with reddish spots, was described as venereal, hereditary, and in some cases developed later into leprosy. Plumbe (1837) in England and Rayer in France are about the last to mention the disease as a distinct entity. These above mentioned Commissioners reported the disease to be leprosy, and to prove their case they referred to the ancient text of Areteus (c. 120–200) and to Schilling (158). Schilling, (157), a Dutchman, who described the disease in Surinam, had written in Latin what is perhaps the first book on yaws, which he called "jaws." In this work he describes the initial lesion as *"matrem jaw"* (mamma yaw) and the *"crabble jaw"* (crab yaw), a term applied to the plantar keratosis with cracks and fissures, and which took its name from a peculiar manner of walking. The French Commissioners (134) cite the fact that the arrival of negro slaves from Africa with *mal rouge de Cayenne* was so common, that at first it became the custom, and afterward the law, to require the physical examination of negroes upon arrival. The problem of segregation was solved in 1777 by abandoning these unfortunates on Devil's Island, off the coast of this colony, an island made famous by the Dreyfus episode. Drs. Peña Chavarría and Shipley (129) and Dr. Villanueva Urrutia, of Tuxtla, Chiapas (174), consider *mal rojo de Cayena* as a synonym for carate and mal del pinto. One of the earliest settlers at New Orleans, Le Page du Pratz, tells how it was a custom in that colony for a surgeon to examine all slaves arriving from Africa for the evidence of yaws (80 *loc. cit.*). It was long believed that yaws was a disease peculiar to the negro race alone, and it is commonly believed by those who have studied this subject, that this treponematosis among the negroes in the Caribbean basin was brought by them from Africa (23). It has been commonly stated that the first account of yaws was given by William Piso in 1642–48. The facts are that, under the name *lue indica* he mentions, without circumstantial description, a disease not only present among Americans but also among the Portuguese and Belgians. He states the disease, endemic in Brazil is known as *bubas* to the Spaniards, and *mia* among the Brazilians. The word *yaws* or anything like it is not in evidence (131). According to Silva, pinta has long been recognized in Brazil having been mentioned by Ribeiro Sam-

paio (139). Velasco (171), noting its presence in Colombia in 1789, says that it was first imported by African slaves.

PINTA IN MEXICO

Flores (41) on the authority of Hernandez (70), believes that mal del pinto was known to the Aztecs as *tzalzayanalizli*. The infection of *bubas* carried by the conquistadores who accompanied Cortez has already been referred to. According to the accounts that have recently been written of the history of pinta in Mexico by Alicia Reyes (138), González Herrejón (63), and León y Blanco (93) the word pinta as now applied to the disease appears to be of comparatively recent origin, and dating only to 1825. Other names like leprosy (48), *enfermedad chiapaneca* (10), and tiña ʼ(28, 109), are previously identified for this disease.

In the Index Catalogue of the Surgeon General's Office (2nd, series, vol. 13) we find a book written in 1574 in which the term "pinta" is used as a synonym for the fever *tabadillo* (168). This disease, appearing under the title "pinta," was however a febrile condition, and this name was applied in Spain to typhus or spotted fever (27. 122, 173). Editions of the Dictionary of the Royal Academy in Spain between 1726–1798, defined *pinta* as the disease commonly called *tabardillo*. Even today the fever is known in Mexico under this name, and about 20 years ago a commission was appointed for the study of tabardillo (14). The latter part of the fifteenth century the spotted character of this disease resulted in its being confused with and mistaken for an epidemic febrile form of syphilis, with a high mortality rate. The disease typhus as a separate pattern or entity, was not generally recognized until the middle of the sixteenth century. Epidemics of typhus constituted a large part of the so-called epidemic of syphilis, described about the time of the discovery of America (72, 73). Those who consider themselves the sole proprietors of a knowledge of the infectiousness of syphilis, and believe it once existed in an epidemic febrile form with a high mortality, and spread about the whole world with a sleight-of-hand rapidity, should improve their knowledge both of the treponematoses and of those diseases that cause epidemics.

The initial papule of mal del pinto, developing in course of time to an erythemato-squamous lesion, followed in the course of time by other like lesions, lesions with hyperpigmentation to which are attributed the blue or dark stains, and ending in an atrophic depigmentation, the white lesion, thus ends in the condition ·called leukoderma and vitiligo. This term *vitiligo* as has been stated was first used by Celsus; but James Gieve and Alexander Lee in their translation of Celsus, discarded this term and rendered the term

vitiligo as leprosy (25a and c). From such translations of the Latin text of Celsus by James Gieve and Alexander Lee, in view of the latter's influence as a teacher a little over 100 years ago, when this work was used as a textbook, a confusion was given birth. It should not be strange or remarkable, therefore, that the disease as seen among the dark-skinned races, should be called "leprosy" in many texts of the nineteenth century. The thirteenth chapter of Leviticus, which treats the condition as communicable and requiring segregation, would support any such notion.[1]

The Provincial Governor of Chiapas who commissioned Dr. Antonio María Berecochea to study the disease in that State, April 18, 1811, referred to it as leprosy. So did Schilling (158) and the French Commission (134). The manner in which diseases caused by a treponema have been called leprosy comes to notice again and again. A monograph supporting this thesis written by Maxwell in 1839, earned a gold medal for its excellence from the University of Edinburg (118). The confusion lives on, but if it be true that a treponema is the causal agent of syphilis, then the idea is now as dead as the idea of 50 years ago that an atom was the smallest particle of matter, indivisible and incompressible. The quantum theory has wrecked this notion. Theories die, facts live, yet error is nursed by ignorance and prejudice.

The term *tiña* is a Spanish derivative of the term *tinea* as employed in the Middle Ages. Gaddesden (1280–1361) and others have described it as a beginning form of leprosy that was transmitted by venereal exposure. Andrés de Laguna (1499–1560) defined the *empeine* as a species of *tiña seca* (Dict. Roy. Acad. of Spain 1726–1739). It was formerly employed in Mexico as a synonym for mal del pinto, but we know of no paper dealing with pinta in which the name *tiña* is preferred in recent years.

One of the terms of interest which has come to light, as in common use among the native peoples in southern Mexico to describe the

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[1] It will be recalled that in the thirteenth chapter of Leviticus the priest was to take special note of the color of the hair: "and the priest shall look; and, behold, if there be a white rising in the skin, and it have turned the hair white, and there be quick raw flesh in the rising, it is an old leprosy in the skin of his flesh, and the priest shall pronounce him unclean; he shall shut him up; for he is unclean." We will find this same sign given in the Brevarium of Joannis Seraponis (Yahyā ibn Sarbi or Janus Damacenus, died cir. A. D. 930) wherein, Tract. v. Cap. v; *De morphea alba r nigra*, he describes the white morphea (Venetian edition, 1497). This change in the color of the hair is also noted by Valescus de Taranta (fl. 1382–1418) in his chapter on morphea, dealing with the prognosis of the variety that he calls *vitiligo alba*. One may also note a change of the hairs to white in the lesions of yaws as described by Maxwell (118) and by Winterbottom in 1803. (See ref. 23, p. 104 and 107.) It is now interesting to note that the commission to study the disease in Venezuela (136) reports the typical color of the carate lesion as lead-gray, often with bluish tones; sometimes almost black. The achromatic patches (white or depigmented areas) occasionally showed a pinkish tinge. It was felt that there were two kinds of decoloration: One an active type, modified by treatment, the other residual. In the active type the hair retained its normal color, *in the latter it became white*. (R. C. H.)

initial lesion is the term *empeines* (90). This term from the vernacu-
lar, has been of long use in Spain to describe a skin lesion. The
earliest mention I have noticed in medical texts, is in *Thesoro de pobres*
by Juliano Pedro (128), who is better known as Petrus Hispanus (Pope
John xxi, 1276 A. D.) In cap. xi, *Para Sanar la rosa de la caro o el
empeyne o otra manzilla*, he gives a number of remedies, without
describing the character of the disease. So, too, there is a chapter
in the work of the earliest protomédico of Spain, Alfonso Chirino de
Cuenca (26), cap. viii; *de los empeynes*. Here again we have no cir-
cumstantial description; only the treatment.

One of the first books written on the diseases of Mexico is that of
the friar Bernardino de Sahagún (1499–1590), who first went to
Mexico in 1529. In this work (154) we find between a paragraph on
the treatment of the bubas (syphilis) and leprosy, a paragraph en-
titled: *Para la enfermedad de las empeines*. Here, also, there is no
circumstantial description of the disease, only an account of treat-
ment with native Mexican plant remedy simples.

There has been a common agreement among early Spanish medical
historians that the word *empeines*, or *empeynes*, corresponds to the
lichen of the Greeks, which is the impetigo of the Latinists after the
Carthaginian, Cassius Felix. It is also defined as *scabiem siccam*,
scabiei scamosum and *tiña seca*, a dry scaly tinea or scabiness (27).[2]

The first technical description of the word *empeines* is given by
Ruiz Díaz de Isla (149). He describes it as a lesion of early syphilis;
his account of the lesion and its location resembles the ringworm
yaws lesion seen on the neck of native peoples. He describes it as

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[2] There is a passage quoted by Peña Chavarría and Shipley (p. 651–52), which is alleged
to have been extracted from "chapter 10" of the *Historia Natural y General de las Indias*,
etc., of Oviedo y Valdez (125). A part of the passage I found in his *Sumaria*, published in
1526, but not the part concerning carate, nor could I find it in any "chapter 10" of the
20 books of the early edition of the *Historia* (either the first edition of 1535 or that of
1547). In the large four-volume edition of the *Historia*, published 1851–55 by the Royal
Academy of History, there is a glossary of American words employed by Oviedo. Among
them is the word "carate" from the Indian language of Castilla del Oro (which includes
Panama and the coast of Colombia). The word is defined here as "a leper, gafo, covered
with herpes or filthy scabs." The passage in question deals with a method of travel by
Indians, who might be conveyed in a hammock suspended from a pole, the carriers at
either end being slaves or servants. That part of the passage that I have been unable to
find in the early editions, says these slaves were called "carates," and the missing passage
may be rendered as follows: "And in order to understand what the carate is, I will tell
you that carate is a name given to an Indian who by nature has the whole person, or the
greater part of it, throwing off scabs from elevated areas of the skin after the manner of
empeynes. These present an ugly appearance. More commonly they are severe, of greater
violence, and frizzled in appearance. And this is a disease that in the end spreads itself,
itching, all over the body, or the sickness ends when it has altered the whole skin of the
individual."

Peña Chavarría and Shipley, commenting upon this passage, consider it a proof that
the disease is of American origin, and preceded any importation of the African slaves.
However, the passage describing carates, appears to have been added to the text a half
century or longer after the discovery of America, and long after a flourishing trade in African
slaves.

spreading on the edges and healing in the center (72). He also describes it as communicable, as reported in the experiments of León y Blanco (103, 104, 105, 106). Ruiz de Isla, after stating the highly infectious character of the serum or discharge of the early lesion, cites several cases of extragenital infection as proof of its virulence, which are among the first in the post-columbian literature (72). The third case of this character, which he describes as having seen, was that of "a cavalier, who while riding had placed his hand upon the neck of a footman servant, and this servant had an *empeine of the first stage* upon the neck, and on that part of the hand that touched the *empeine*, a *buba* (chancre) arose."[3]

He says the first species or stage does not extend beyond 1 year. He also describes at length the palmar and plantar keratosis with cracks and fissures, a lesion common among cases of yaws in barefoot peoples, and also in syphilis. I have seen it frequently among negro laborer patients with syphilis in the United States.

It is worthy of note that Corona, writing in 1811, considered that the disease was endemic to Chiapas. He called the disease Tiña and says that it never appeared as the white or black variety at its beginning, but first appeared in the form of empeines, spreading from the center and developing the black, blue or white spots later. León y Blanco regards the description of this author as one of the most exact descriptions of the lesion at its initial stage by a Mexican author.

There is a word to say of those other characters belonging to syphilis which ought to have attention. One of the earliest descriptions of the disease which refers to a possible venereal origin is in the bibliography of Alicia Reyes and León y Blanco. This is the account of Alzate y Ramírez (1787). He states that in the vicinity of the volcano Jorullo, in Sinaqua, many of the population had black spots, and in others the whole face was black. According to his information it was commonly believed among the people that the disease had its origin from an Apache Indian woman, a fugitive from Mexico, who had commerce with cattle herdsmen. On the other hand, he personally believed that it arose from the nature of the country, or from the recent eruption of Jorullo. J. J. León, Chassin, and Iturbide all considered the disease hereditary (49). Mueller (1874) considered that the disease was of a hereditary character but not contagious. Personally, I am persuaded the evidence is accumulating that pintalike lesions appear at times among the other stigmata of congenital syphilis. Finally Barbe (8) says the spots

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[3] E vi un cavallero que yua cavalgando y puso la mano a un criado suyo moço de espuelas en el pescueço y el moço tenia vn empeyene en el pescueço de primer especie y con la parte de la mano que le toco en el empeyne le nascio una buba (cap. ii. folio xiii).

of mal del pinto may occur on the mucous membrane of the mouth, tongue, glans, and prepuce of the male, and vulva in the female. A similar statement is made by E. Gaucher (50). It has already been mentioned that the Mexican Commission reported mucous membranes affected in 72,873 cases (32, 44). If lesions appear on mucous membranes the possibility of venereal transmission from genital secretions and discharges is open to consideration and should not be ignored. There is nothing to show that these treponemata discriminate as to the method by which they are transmitted where the circumstances are favorable.

As for the character of the lesions as observed in Cuba, Sáenz *et al* (153) say that until 1929 the disease was considered to be a special type of syphiloderma of the palms and soles. In 1929 the disease was presumably identified with carate, and a third phase began in 1938 with the discovery of the treponema. A fourth phase, it would seem, are those contributions to an understanding of its constitutional character, notably the lesions of the heart and aorta and the positive spinal serology noted by some. From 1938 to 1941 is too short a time in so chronic a disease to assemble a new concept of the whole pattern.

A review of the literature would seem to me to indicate this syphiloid is one of many disguised evidences of the antiquity of syphilis. The trail of the treponema comes to the surface again and again amid the flotsam and jetsam of those historic infections whose dimensions are endemic, lifelong, hereditary and venereal. In dark-skinned races disturbances of pigment are more noticeable, disfiguring, and suspicious of an infectious character than in the Nordic type. Much merit belongs to those workers in Cuba, Mexico, Colombia. Venezuela, Ecuador, and Brazil who have lifted this disease out of the class of the mycoses, and presented it in a pattern of the treponematoses.

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THE "SOLACE" IN ACTION

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It is indeed quite unusual for a hospital ship to be in the midst of an enemy attack. Since the *Solace* was present and had her baptism of fire during the attack of Pearl Harbor, on the morning of December 7, 1941, the writers of this article had ample opportunity to observe the action and the subsequent results.

Patients started coming on board within a few minutes after their injuries were sustained. Over 70 percent were burn cases, the remainder consisted of compound fractures, shrapnel wounds, machine gun bullet wounds, lacerations, etc. Nearly all of these also had some associated burned areas. Many were so seriously burned that they could not be recognized. Those who were conscious tried to mumble their names, no one whimpered; their morale was high.

Approximately 141 patients were received on board, the majority coming during the attack. This figure is in all probability much less than the actual numbers because many slightly wounded men were given emergency first-aid treatment and returned later in the day to their stations, subsequent treatment being carried out by their

own medical officers. All severe cases received morphine as they came over the quarter deck. In this connection we found the morphine "Syrettes" of great service.

During the first 24 hours, 26 patients died. Most of these were either dead when they came over the quarter deck, or were moribund, the great majority dying within the first 12 hours after arrival. Ten patients died in the second 24 hours, and one in the third 24 hours. There were no subsequent deaths.

We wish to stress a very important point. These burns were for the most part "flash" burns due to bomb explosions, not of sufficient duration to burn their clothing. Hence, only exposed surfaces were burned; even an undershirt or shorts appeared sufficient to prevent the areas covered from being burned.

As has been stressed by writers in the past, shock is the primary cause of death in the great majority of war injuries. We feel that all patients coming on board under these circumstances are either in actual or potential shock. The problem of shock here is vastly different from that sustained in civil life. When a civilian suffers injury in an automobile accident and is brought to the hospital for treatment, he may or may not be in shock due to the physical and mental trauma of the accident. He does, however, realize that as far as the accident is concerned, he is now safe and that the "worst is over." The problem of the patient receiving medical care during an attack, however, is different. He has the added factor of not knowing whether the next moment will be his last. For this reason, we believe it is most important that patients immediately be given sufficient morphine, whether they need it or not, to dull the pain and take the edge off the so-called psychic trauma.

A fact familiar to everyone is that there is a tremendous loss of plasma in the severely burned, a leading factor in the production of shock. Two methods are used to overcome this. One is the immediate application of tannic acid or some similar substance to produce a good eschar as quickly as possible and thereby prevent the further loss of plasma. The second method is the replacement of plasma by adequate amounts given intravenously. From our observations we have concluded that if a patient needs plasma, he should be given it in adequate amounts—namely 750 to 1,000 cc. or more if necessary, supplemented by intravenous saline and glucose solutions. The usual methods of combating shock should, of course, be employed, namely, lowering the head, application of heat, and the use of morphine, etc.

The problem of giving intravenous therapy was a great one because in all of these moribund cases, one had to go through a burned area to find the vein, and it was necessary to cut down on practically all of them.

Fuel oil, itself, seems to be a factor in the production of shock. We saw a number of patients who had been completely immersed in fuel oil, all of whom were in shock, even though there was no sign of any injury. Upon removal of the fuel oil, they immediately came out of the shock and in a few hours were entirely normal.

In the local treatment of the burn cases, we used the simplest and most available remedy—tannic acid. Since the attack was unexpected we had to improvise. Numerous clean stainless steel buckets were collected in the pharmacy. One pound of tannic acid crystals was added to each bucket of water and the buckets then distributed to each operating room, dressing rooms, and wards. No attempt was made to observe sterile precautions. Dressings were soaked in this solution and placed on or around the burned areas. Many of the cases came on board with tannic acid dressings already applied, these were not disturbed except to keep them wet during the next 24 hours when all the dressings were removed. No attempt to debride was made for 3 or 4 days. On the second day after the attack, numerous improvised bed cradles were made since we did not have a sufficient number on board to take care of all the cases. With all the dressings removed, tannic acid solution was sprayed on all surfaces which did not show a firm eschar. No distinction was made; the face, hands, and feet were treated like any other part of the body. The eyes were protected while the face was being sprayed.

The problem of removing fuel oil from the burned areas is a very real one. We found that the most effective method was the use of tincture of green soap and water. This may be supplemented by prior cleansing with plain mineral oil. It is imperative that this be done in order to get a good eschar with tannic acid, but it should be accomplished as gently as possible, and with a minimum of trauma to the patient.

The early debridement of burned areas, mentioned in many text books on the subject, is referred to only to be condemned. This is a long tedious procedure, and we believe it is a great factor in the production of shock which one so zealously tries to avoid. We did this in none of our cases and we feel that the results bear out this point.

After the first 6 days, we had 26 cases of severe burns on board. We do not include in this group those cases with burns of lesser degree, namely, one extremity, or patchy burns of small areas. In practically all of these 26 cases one-half to three-fourths of the body surface was burned, and in 2 cases every part of the body was burned except for the small area covered by shorts. There were practically no third-degree burns, the vast majority being second-degree.

The following standard routine treatment has been adopted for use on board this ship:

1. Fresh tannic acid solution is made by adding 1 pound of tannic acid crystals to a bucket of fresh, ordinary, drinking water in a clean stainless steel bucket. This solution is not stable and should be discarded every 24 hours. It is prepared in the pharmacy and distributed to the various activities.

2. After removal of burned clothing, no debridement is done. If, in addition to burns, the patient is coated with fuel oil—this can be removed from the burned areas with tincture of green soap and water. The areas covered with oil, if not burned surfaces, need no immediate attention. Severely burned cases are in a condition of shock; consequently, our purpose is to treat that shock.

3. All burned surfaces are sprayed with tannic acid solution and the patient placed under a tent. The areas are sprayed every hour until a firm, protective coagulum has been established; this usually takes about 24 hours. If, for any reason, the ward medical officer in charge of the ward determines that a quicker coagulum is desirable, he may spray a 10 percent silver nitrate solution after the first application of tannic acid—usually one application is sufficient. The eyes must be protected in all cases. Judging by our recent experience, we are of the opinion that tannic acid is not contraindicated in first- and second-degree burns of the face and hands. When the ward medical officer deems it necessary to heat the tent, one electric light bulb is considered sufficient; however, care should be taken in this selection as the connections are a fire hazard.

4. After the formation of a firm coagulum, there is no longer a loss of plasma, hence no further local treatment is necessary until the coagulum begins to separate which is, ordinarily, after the third or fourth day. When separation begins to occur, the coagulum is covered with vaseline and removed only when it separates without effort.

5. Intravenous medications such as blood plasma, glucose and saline, or blood transfusions are left to the discretion of the ward medical officer.

6. Fluids in the form of water and fruit juices are to be forced—the hospital corpsmen will see that each patient takes fluids freely. Fluids—water or fruit juices—should be offered to patients, at least every hour for the first 72 hours—this is very important.

7. The majority of deaths from severe burns occur during the first 12 hours; consequently, that is the period in which we must do our utmost to combat shock and prevent toxemia.

Adequate fluid intake in the treatment of burn cases cannot be too strongly emphasized. In this present day when we are all intravenous-minded, a word on fluids by mouth may not be out of order. In a large ward filled to capacity with desperately ill patients and with a limited number of hospital corpsmen available, it is all too easy for a patient, unable because of burns to motion or to speak, not to get sufficient fluids even though he may desire it. We insisted that one corpsman during the night make the rounds of each patient at least once every hour and offer water or some other liquid such as fruit juices, etc. This is a very simple procedure but we believe it is a very practical one.

During the recent months, numerous articles have appeared in various medical journals concerning the efficacy of tannic acid in the treatment of burns. Many objections have been raised to the use of tannic acid solution on the face and hands because of the resultant scarring.

We feel that in first and second degree burns of the face and hands, one is perfectly safe in using tannic acid and our results bear this out. We are not prepared to render an opinion on third degree burns since we did not have a sufficient number of such cases to judge. Using the described routine (p. 555), we did not see any cases of gross infection beneath the eschar and no cases of scarring when the eschar was removed.

Many, in fact most, of the severe burn cases were complicated by multiple shrapnel wounds. The word "shrapnel" is used here as a matter of convenience and not in the technical sense since in the majority of cases they were really fragments of shells. We shall discuss the treatment of these cases under a separate topic—delayed shock and shrapnel wounds.

In any discussion of shock the mental factor is always mentioned, but in our present age of dependence on the laboratory, we are prone to forget that there is a factor which cannot be measured by our known methods of detecting impending shock, such as the hematocrit reading, etc. This was impressed upon us by two rather disastrous cases, the outcome of which radically altered our concept of the treatment of war wounds.

From the observations of men in the World War, it was considered that the sooner a gunshot wound or a shrapnel wound was subjected to thorough debridement, the less likelihood there would be of severe infection. With this in mind, two patients with rather mild shrapnel wounds, with very little loss of blood, were operated on the night of December 7. They were, according to all our present standards, in excellent shape for operation. Nitrous oxide anesthesia was used. Debridement was carried out, the wound cleaned, and the shrapnel removed. Neither patient was on the operating table more than three-fourths of an hour. Several hours after operation, both suddenly went into shock and despite all the measures previously described, they died in the next 2 hours. We were at a loss to account for these deaths except in the following manner.

One must consider these patients as having sustained some physical trauma but also a very definite severe mental trauma. Added to this is the fact that they are aware that the attack is still in progress or that another is quite likely to take place at any moment. If left quiet and comfortable, they compensate well and gradually become mentally adjusted to the situation. The added trauma of surgery, however, plus the apprehension of an impending attack is just enough to throw the balance the wrong way into what appears to be almost an irreversible state of shock.

With this unfortunate experience in mind, we operated on no more patients with shrapnel wounds for several days, until a complete mental readjustment had taken place. In the intervening period, we left the

wounds wide open and packed them with sulfanilamide powder and covered them with a sterile dressing. In none of these cases (with one exception), totaling 25, was there any evidence of gross infection. This was a case of extensive muscular damage which later responded well to treatment. We believe that these results justify the postponement of surgery for several days, provided that sulfanilamide is used liberally. Many of these wounds were on severe burn cases and these were treated in a like manner. The above-mentioned method of delayed surgery does not, of course, apply to abdominal wounds, hemorrhage, or to such cases where the shrapnel is impinging on important structures. Fractures will not be discussed in this paper.

SUMMARY

The treatment of shock, burns, and shrapnel wounds were discussed from our experience gained during and after the Japanese attack on Pearl Harbor on December 7th, 1941.

CONCLUSIONS

1. Every patient admitted during an engagement is in shock, either real or potential.

2. Adequate plasma—75 to 1,000 cc., or more if necessary, is the cardinal principle in the successful treatment of shock.

3. Mental trauma is an important factor to be considered in treating war injuries.

4. The tannic acid treatment of first- and second-degree burns gives most excellent results.

5. Extensive early debridement should be avoided in the treatment of burns.

6. Since the majority of the burns were of the "flash type" from exploding bombs, it is recommended that all men wear trousers and jumpers during an engagement.

7. Sulfanilamide powder used liberally in shrapnel wounds will enable surgeons to defer surgery for several days with little or no danger, until such a time as the patient becomes readjusted, and surgery carries less risk.

NEWER CONCEPTS IN THE TREATMENT OF BURNS

WITH SUGGESTIONS FOR THE MANAGEMENT OF WARTIME THERMAL INJURIES

By Lieutenant, junior grade, Theodore A. Fox, Medical Corps, United States Naval Reserve

In 1925, when the tannic-acid treatment of burns was introduced a remarkable step forward was made in reducing the morbidity and mortality of thermal injuries.

It was soon discovered that tanning (with the later modification of applying silver nitrate to the area) relieved pain by protecting exposed nerve endings and stopped the escape of precious body fluids by forming a damming eschar over the raw area. Both were important factors in reducing shock. However, the method had two marked disadvantages.

In the first place, it was necessary to scrub the patient thoroughly before applying the tannic acid spray for every effort had to be made to cleanse and "sterilize" the skin before applying, because tannic acid is not bactericidal. Infection, and associated toxemia, once started beneath the tough protecting, but masking eschar, would often be the cause of the patient's death. This dire complication is usually due to contamination of the raw surfaces before the tanning takes place and the eschar forms. The burned area is sterile for some time after the injury, as bacteria are killed by the same physical cause that kills cells and tissues. Toxemia is the second most important complication as a cause of death from burns; shock is first.

Secondly, when the epithelization occurred under the tough, inflexible eschar, the cells of epithelium that grow into the burned area from the unburned margins were not "normal" in that they, too, had been "tanned." The connective tissue beneath, instead of being elastic, forms tough, contracted bands under the deformed epithelium. This grave aftermath, usually of third-degree burns, frequently causes more concern than the original injury, especially if the face, neck, hands, or flexor surfaces of the extremities are involved. The patient recovers from the burn but is frequently left a deformed, crippled monster. Infection further increases the scarring, even though sulfon-chemotherapy has reduced the morbidity. The patient faces months of painful and expensive plastic surgery in order to return to a semblance of normality.

Not only is tannic acid (even with silver nitrate) nongermicidal, but it has the added disadvantage of being extremely unstable, necessitating fresh solutions whenever needed. Such an eschar is thick and likely to crack, and if the surface to be tanned is already infected, it will not "take."

It was plainly seen after some years' experience with this treatment that for the reasons discussed, the tannic acid method could be improved upon. What other methods could be used to give an antiseptic, analgesic eschar that would provide a dam for escape of tissue fluids, stimulate normal epithelization, and form a nondisfiguring scar?

Aniline dyes had been used in connection with burns for years; singly they did not seem to have the proper qualities to displace tanning.

In 1933 Aldrich (1) (2) happened upon the ideal combination of these dyes. He showed by culturing burns that they were sterile (due to thermal injury of the skin) up to 18 hours after the injury occurred. If the patient showed no signs of toxemia after this, the wound remained relatively sterile. Up to the 72d hour a mixed type of infection could be cultured from the wound surface; and after that period, pure cultures of beta and gamma hemolytic streptococci could be demonstrated in a toxic patient. Aldrich felt that the infection was the cause of this early toxemia, rather than the previously suggested split proteins, and he was able to prove his thesis experimentally, not only by surface culture of the burn, but from blood cultures as well; he also showed that only infected cases became toxic. This led him to search for an eschar-forming dye that was noninjurious to the tissues, yet strongly germicidal. He found that gentian violet was effective against the gram-negative organisms. But it was not until he mixed crystal violet and neutral acriflavine (acriviolet) and brilliant green that he was able to kill the gram-positive organisms as well as the gram-negative, yet not injure tissues. Not only did these dyes in combination (1:1,000 solution) kill off all germs; they formed a tough, purple-brown, supple eschar to seal off the area, and provided excellent analgesia as well.

If a local area becomes infected in spite of the triple-dye treatment, it is not masked until late in the course of this complication, as it is in the tannic-acid method. By daily observation, a softened, moist area can readily be detected and by simply trimming it out and respraying the denuded area, one can quickly end this complication.

The three-dye mixture consists of 1 percent aqueous solution of crystal violet (gentian violet also is used) and brilliant green, and a 0.1 percent solution of neutral acriflavine. This mixture is quite stable and can be prepared and stowed for a long time without losing its efficiency. The crystal violet is a specific for gram-positive organisms and has a definite analgesic action in that it coagulates with plasma proteins to form the eschar protection for the exposed nerve endings. The neutral acriflavine and the brilliant green dyes have special germicidal action against gram-negative organisms. In dilution of 1:1,000 the mixture has a phenol coefficient for many of the pyogenic organisms. It is nontoxic to normal tissues; although it stains skin, mucous membrane, and granulation tissue (in fact, everything it comes in contact with), a purple-brown color.

Although dyes are messy to handle, th's is insignificant in view of the facts that the morbidity and mortality from burns and the incidence of scar deformity have been markedly reduced with this treatment. Aldrich himself states that he does not "wish to give the impression that by merely spraying with this dye there will be no

mortality. The use of the triple-dye makes treatment easier," but other aspects of the treatment, i. e., treatment of the patient, in general, cannot be neglected. He further adds that "it is not the final answer to all problems presented by a burn patient," even though the method is applicable as well to third-degree burns. Contrary to popular opinion, if no infection remains in these carbonized areas, the islands of epithelium that are spared (usually around hair follicles) are enough to grow and spread. Some mild contracture of scar and an occasional infection occurs with this method. "If a new substance is found it will have all the properties of the triple-dye method and yet be an improvement." In other words, this new substance would have to lessen still further the possibilities of infection and scarring.

This "new substance" was introduced by Pickrell (20) in August 1941 and is one of the amazing group of sulfon drugs, sulfadiazine (2-sulfanilamidopyrimidine). In this author's introductory series of cases it was found to be much superior to methods previously used for treating burns.

It is a nontoxic, extremely bactericidal, analgesic substance that forms a tough, thin, pliable and transparent eschar. No contractures resulted in any of Pickrell's cases, even when used around the eyes. It makes the patient so comfortable that 100 of the 115 cases treated were able to leave the hospital on the day of admission and be observed as out-patients. Like the triple-dye method, no traumatizing scrubbing of the burned area is necessary. As the eschar is translucent, the granulization and healing can be observed directly; and it is so elastic that motion can be started immediately without cracking or disturbing the eschar in any way. None of the 115 cases developed any infection while the eschar remained in place.

The solution used is one of 3 percent sulfadiazine in 8 percent triethanolamine. It has a pH. of 8.7; is clear, and has a faint yellow color owing to the oxidation of the sulfadiazine. This, although it doesn't materially affect the efficacy of the drug, may be prevented by storing it in dark-glass bottles. It is odorless, has a bitter taste and does not stain skin or clothing. It penetrates tissues and can be detected in the blood within several hours after being sprayed on a burned surface. After the eschar forms, the blood level approaches a minimum and remains level. Normal tissue is unaffected by the drug. The triethanolamine is nontoxic, as demonstrated in laboratory animals. If the blood level of sulfadiazine is kept below 15 mg. percent (20 mg. percent is the maximum for safety) it can cause no kidney damage. Temporary psychotic episodes and blood dyscrasias are rare with sulfadiazine, although blood counts, urinalyses, and sulfadiazine blood levels, taken at frequent intervals, are

necessary to discover such rare eventualities. Other toxic manifestations as drug fever, drug rash, cyanosis, and jaundice seen in the sulfon drugs are extremely infrequent but should be watched for. However, in Pickrell's series only one case showed drug toxicity (kidney damage) even though sulfadiazine was administered orally to some patients as well as being used to treat the burn.

The treatment of burns is divided into two parts:

(a) Treatment of shock (primary, secondary, or tertiary).

(b) Treatment of the burn itself.

Treatment of shock should be undertaken *at once*. The most critical period for a burn case is 8 to 12 hours after the injury occurred. If the patient has had a relatively severe burn and is not in shock, treat him as if he were. The treatment of the burn should not be begun until the shock therapy is well under way and the patient has a normal temperature, relatively normal blood pressure, a good pulse and respiratory rate, and his skin is warm and dry. Continue shock therapy while treating the burn. Wrap the patient in sterile sheets to protect the burn and *treat the shock*.

Primary shock is that stage that comes on immediately after the injury and is similar in every respect to surgical and traumatic shock. The contributory causes are:

(a) The general withdrawal of blood plasma into the tissues and loss of plasma from the burned surfaces.

(b) Severe pain from the exposed nerve endings.

Plenty of morphine should be given. Grain ⅓ to ½ can be administered with impunity and repeated every 4 hours, or as often as necessary to keep the patient comfortable. Pain itself is an excellent antidote for an overdose of this narcotic. So keep the patient free from pain.

Apply external heat in the form of heated blankets or a heat cradle. Hot-water bottles, electric pads, or anything available should be used to keep the patient warm.

Elman (8), Black (4), and others have definitely shown that the volume of blood during this stage is depleted by loss of plasma through the capillaries and larger vessels, and from the burned surfaces.

The administration of plasma at this time is to be strongly advised. If possible, plasma should be given to *all* severe burn cases. If this is not available, whole blood may be used although this adds erythrocytes to an already too viscous blood. Parenteral fluids are contraindicated for they further dilute the blood proteins and only temporarily stay in the peripheral circulation.

Rhoads (22) and his coworkers, Ivory (16), and others, have shown that the use of adrenal cortical extract (eschatin, cortin)

decreases capillary permeability and helps maintain the plasma level in the blood, thus reducing the incidence of secondary shock in severe burns.

Stimulants such as ephedrine sulfate (grain $\frac{3}{8}$), adrenaline (minims V–X) or other pressor substances; caffeine sodium benzoate (grains 7.5), strychnine sulfate (grain $\frac{1}{30}$), coramine (1 cc.), metrazol (1 cc.), may be administered parenterally if indicated; however, the above treatment should make their use unnecessary, except as a heroic measure.

The patient's head should be kept low (Trendelenburg position) to increase and maintain cerebral circulation. Due to the anoxia as a result of diminished blood volume and poor peripheral circulation, as evidenced by the high blood viscosity and low arterial blood pressure, it is recommended that oxygen be administered throughout the entire shock therapy by means of a Boothby mask. Poor oxygenation of the tissues is the prime factor in causing parenchymatous damage.

Secondary shock occurs from 10 to 20 hours after the injury, but may be delayed as much as 2 or 3 days, and is the so-called histamine shock of Cannon (absorption of tissue-break-down substances). The author believes it is merely a more extreme form of primary shock and should not occur if the patient is properly treated. It is due to increased hemoconcentration and can be treated with plasma transfusion and prevented by the use of adrenal cortical hormone. During this stage the viscosity of the blood, which normally is 2.4 (taking water as 1.0), increases to 4.0 and 5.0.

Third type of shock is relatively uncommon and if present makes the prognosis very grave indeed. It is a prolongation of the second phase with a blood viscosity so great (6.0 to 7.0), that the patient's own cells act as thrombi and emboli to cause cerebral, liver, and kidney damage. This stage of shock is hard to treat, for fluids injected into the venous side of the circulation cannot be pumped out to thin the capillary blood. Prevention is the best treatment for this stage.

Burns are classified as first degree (stage or erythema), second degree (erythema plus bullae formation) and third degree (stage of carbonization; erythema with bullae are also present).

In discussing the treatment of the burn itself, the general details will be taken up before going into the specific methods for the triple-dye and the sulfadiazine-triethanolamine technics.

In general the following procedures are followed in the order in which they appear:

(*a*) Wrap the patient in sterile sheets and proceed to the operating room.

(*b*) Treat the shock; do not proceed until you feel reasonably assured that the patient is out of shock, and is being treated for shock during the burn treatment. (See above.)

(c) Don mask and cap. All observers, assistants, and nurses do the same. Remember outside contamination (especially droplet contamination from the noses and throats of spectators, etc.) causes infection of burns.

(d) Scrub up in the usual manner; don gown and gloves (all assistants do the same).

(e) The burned areas are gently and carefully debrided of all dead tissues and bullae. The area is not cleansed or scrubbed in any way unless to remove, gently, previously applied grease or oil. Antiseptics are not applied to traumatize further the tissues.

(f) The dye or sulfadiazine solution is sprayed on the debrided area with an atomizer as outlined below.

(g) If delayed blisters appear 24 to 72 hours or more later, the above procedure is repeated.

The triple-dye method is as follows:

(a) Follow the above outline in preparing the patient. *Treat shock!*

(b) The dye solution (1 percent aqueous solution of crystal violet and brilliant green and 0.1 percent solution of neutral acriflavine) is sprayed on the burned areas every hour for 8 hours. An eschar forms at the end of the first or second spraying, but is not complete until the end of 8 hours.

(c) Keep a heat cradle (not over 90°) over the patient.

(d) Observe the eschar daily for soft, moist spots.

(e) Excise soft, moist (infected) areas, gently sop up secretions with a sterile sponge, then respray as above.

(f) Continue daily observations until epithelization is complete or the granulation tissue is built up enough to take a graft.

(g) In case of massive infections (seen where burns occur around body orifices and are continuously being contaminated), the eschar may be removed and the raw surface treated with saline spreads until clean and then resprayed.

(h) No dressings of any kind are applied.

(i) The eschar comes off in about 1 to 3 weeks with the surface beneath more or less normal skin. Rarely and only where the burn is third degree is a skin graft needed.

The sulfadiazine-triethanolamine method is as follows:

(a) Follow the same general outline for preparing the patient. (See above.) *Treat shock!*

(b) Spray the burned area with the solution every hour for the first 24 hours. A heat cradle at 90° should be used.

(c) Spray every 2 hours the second day.

(d) Spray every 3 hours the third day.

(e) Spray every 4 hours the fourth day. By this time a thin translucent eschar has formed that is soft and pliable.

(f) Encourage active motion; and if the burn is not too extensive, allow the patient up and about. Or, if the burn is less than 20 percent of the body surface, discharge from the hospital. Motion prevents contractures.

(g) In about 10 days the eschar begins to loosen from the epithelium beneath. Applications of the mixture or saline compresses speed the separation. In third-degree burns, allow the eschar to remain in place for 3 weeks. This type may need grafting. This is done after saline spreads have been applied for several days. Observing the burn through the translucent eschar makes the rare infection easy to detect. If present, soak off the eschar and respray.

(*h*) Ambulatory patients, i. e., those treated and sent home within 24 to 48 hours, are sprayed frequently during their stay in the hospital and the burns covered with sterile vaseline gauze or an ointment made up of 5 percent sulfadiazine and 8 percent triethanolamine. In these cases no eschar forms, so they are seen every 24 to 48 hours and the burns resprayed and redressed with the vaseline gauze or the ointment. This is repeated until the burn has healed.

During wartime the treatment of burns presents several added problems. In the first place, they are usually complicated with other injuries such as fractures and soft tissue wounds. Secondly, the problem of sepsis is a greater one, because of the great amount of contamination and the inability to give the wounds and burns the immediate care needed to prevent infection. Koch believes that a wound or burn is contaminated and, therefore, potentially septic 2 hours after injury provided no treatment is given the patient in that time. In the author's experience, 6 to 8 hours are the upper limits. However, since the advent of the sulfon drugs and the "plaster-cast-let-alone" treatment, the latter being revived during the Spanish Civil War, it is possible to treat even these potentially infected wounds as "clean." Since the introduction of the sulfadiazine-triethanolamine treatment, this problem should be further simplified.

The spore-forming organisms are all too frequent contaminants of wounds in wartime; the administration of prophylactic doses of combined tetanus-gas bacillus antitoxin is obligatory. Then again, as the eschar seals off the burn from the outside air, a treated burn is an excellent place for the growth of these anaerobic organisms. In civilian practice, some surgeons routinely give at least the tetanus antitoxin (3,000 units) to all their burn cases.

In reviewing the literature extant on the treatment of burns since the start of the present war, it is readily seen that no standardization of treatment has been devised.

It is the author's impression that the greatest difficulty with this problem lies in the failure to set up a definite standard simple plan for first-aid and hospital treatment based on one or the other of the specific methods described in this paper. There are too many diversified forms of treatment depending on the type of burn, its location, whether or not it is complicated by a wound, etc. There can only be one method for routine, standard treatment.

All the British authorities have agreed upon the necessity of treating the shock. They have reduced the mortality tremendously by using heat cradles, plenty of morphine, routine administration of adrenal cortical extract (2 cc. per dose) in liberal amounts, and, best of all, the use of plasma. Primary shock from burns is not seen often in wartime Britain, but 80 percent of deaths from this injury are due to secondary shock.

If the patient has a hemoglobin of over 100 it is obligatory to give him plasma and keep giving it until the hemoglobin readings reach more normal figures. Pseudo-polycythemia is a good index to the increased viscosity of the blood—and taking a hemoglobin and/or red-blood count are easy, quick ways of determining the concentration of blood.

In severely wounded cases British surgeons find it advisable routinely to administer oxygen by means of the K. L. B. mask (Boothby type). The Royal Navy, which has had this type of mask available for use has found them invaluable in saving lives, especially in cases that are complicated by "blast lung."

Hot coffee (6 ounces) by rectum, or by mouth has been a successful adjunct in treating the shock cases. It is an excellent stimulant and helps keep the patient warm. The latter factor is stressed, and a large percentage of injured men that were successfully kept warm at Dunkirk, lived, in spite of the lack of much else in the way of treatment. Any means available was used. Immersion in the sea seemed to help preserve body heat, for none of the burn cases rescued from the Channel were in shock.

As for the first-aid treatment, there are as many methods as there are medical officers in the British Army and Navy. Tannic acid jelly seems to be the most generally used, as all tanks, gun turrets, etc., are equipped with tubes of this material. However, gentian violet, picric acid, acriflavine, paraffin, gentian violet and merthiolate, amertan jelly, tannafax, and tannax all have their advocates.

The tannic acid jelly is the favorite for first-aid applications; and when a burn case is first seen the routine consists of plenty of morphine, keeping the patient warm, liberally spreading tannic acid jelly upon the undisturbed burn (no first-aid station debridement), and applying two or three layers of gauze over it and holding them in place by a bandage. This is left *in situ* until the patient reaches the hospital. Of course, his other wounds are treated, splints applied, etc., at same time the burn receives attention, placing the jelly into wound surfaces if necessary.

The patients mentioned above who were immersed in sea water for long periods had a very low incidence of infection. Wakeley (24) favors the use of gentian violet in first-aid treatment over the tannic-acid jelly because of its more germicidal action, and for this reason even places this material into compound fractures.

After the patient gets to the hospital, he is assigned to a special ward for burn cases and taken to a special operating room. Due to the high incidence of crossed infections, burns are treated and bedded in "clean" operating rooms and wards.

If much dirt, grease, fuel oil, and dead tissue is present after the shock has been treated, the burn is cleansed and debrided under

aseptic conditions, the patient being anesthetized with either intra-venous pentothal sodium or evipal (evipan). No untoward effects were encountered from these anesthetics. Little gas-oxygen anesthesia is used and chloroform and ether are never employed.

The debridement consists of first shaving the hair and removing the fingernails and toenails, if necessary, around the injured parts which are then gently cleansed with ether soap. Cotton pledgets and soft friction are used. The wound is then rinsed; or if deep, irrigated with saline solution. The burned area is then dried with a hair drier.

The triple-dye method is used rather extensively in most British military hospitals. The incidence of infection and toxemia has been dramatically reduced by this method. The tannic acid-silver nitrate method is still used. However, where deformity is feared (i. e. in burns of the neck, face, flexor surfaces, or the hands), this treatment is avoided. The eschar of the triple-dye method, when used on the localities mentioned, is removed as soon as granulation tissue is favorable for skin grafting. This prevents deformity. Wakeley (24) uses a combined aniline dye (gentian violet) tannic acid treatment. He applies the dye first, for its germicidal effect, then tans the area by the usual method.

Splints and casts are used by many surgeons to put the part to rest, but are not applied until all swelling has subsided. Heat cradles are kept over the patient at all times. Limbs are elevated to promote venous drainage and keep down swelling.

Saline immersion baths are used by some men for treating burns, especially third-degree burns and burns of the hands and flexor surfaces. Saline packs are used upon the face. This method also helps separate the eschar.

Mathews (18) uses the "tulle gras" method of treatment. This is a dressing made up of close-mesh gauze and cut into suitable squares, impregnated with soft paraffin (98 parts), balsam of peru (1 part), and olive oil (1 part). These squares are packed in a covered metal container, each separated by white paper to facilitate removal, then the above paraffin mixture (250 gm. for a container 5 inches square and 2 inches deep) is poured into the tray and this is sterilized for an hour at 150° and the container sealed. A local anesthetic (1 percent decicain or 0.1 percent percaine) may be added. This is applied to all raw surfaces and left *in situ* as long as the paraffin base lasts, and should be removed by saline immersions of the part. Some authors have used this method on hand and face burns. Gauze dressings saturated in saline are placed over the "tulle gras."

Cod-liver oil and cod-liver-oil ointments are rather extensively used in Britain, especially for burns of the face and hands. German

army doctors also have been using this method—they use tannic acid for other burns.

Bunyan uses the "bag method" in treating his hospitalized burn cases. This consists of primary irrigation and cleansing with 10 percent electrolytic hypochlorite solution at 100° with the patient under an anesthetic. Coated silk watertight envelopes are then placed on the limb over the burned area. No other covering is used. The envelope is so rigged and sealed at each end that hypochlorite solution can be run through it, irrigating the wound. This is done two or three times daily.

Hudson (15) modified this method of Bunyan's by using impregnated silk as an occlusive dressing (where the bag cannot be used). If a large area of the body is burned, he uses a large envelope that includes the entire body, then applies irrigations of hypochlorite. He also advocates the use of sulfathiazole cream in infected burns.

Extensive and third-degree burns are also treated by a large number of men by the saline-immersion method, 0.9 percent saline at body temperature, which is thermostatically controlled. Some apply "tulle gras" after the immersions, until grafting can be done.

Gas warfare has not been used to any great extent during the present war, and it is beyond the scope of the paper to discuss in detail the treatment of such burns. However, after specific decontamination, they are treated by the usual methods.

Chemotherapy is extensively used as an adjunct in treating burns. Sulfanilamide seems to be the drug of choice. Sulfapyridine is used only if pneumonia complicates the picture (this is not infrequent in severe burns), because of its "toxic reactions" such as nausea, vomiting, etc. Sulfathiazole is prescribed as well as the sulfanilamide, but not as extensively. Sulfadiazine was not mentioned by any of the authors. Powdered sulfon drugs are not used on burns, although they are put into wounds. As previously stated, Hudson (15) uses a sulfathiazole cream and Robson (23) uses a glycerin-sulfonamide paste ("euglamide") in infected burns.

Plaster casts are used in deep burns or where the burns are complicated by other injuries. Casts are not applied until edema subsides. Then the limb is wrapped in sterile sheet-wadding and the part encased in plaster, in the position of function. They are not removed until healing has taken place, even though they become foul-smelling. This is the lesson learned from the recent Spanish Civil War. Apparently a bacteriophage is formed that inhibits bacterial growth in the patient's infected tissues, finally eliminating the infection. Little or nothing is mentioned, in any of the papers reviewed, about the routine administration of tetanus or gas bacillus antitoxins, nor is the incidence of these complications discussed.

In conclusion, the author can only urge that a definite, simple standard routine treatment for burns be adopted by the United States armed forces. In his estimation the sulfadiazine-triethanolamine solution is the treatment of choice. As was indicated, it can be used as an ointment in first aid, and as a solution in the hospital treatment; it is stable, nontoxic, nonstaining, and highly bactericidal. The drugs can be placed into soft tissues and compound fractures or other wounds so that complicated burns need not have separate forms of treatment. It can be safely used on the face, neck, hands, and extensor surfaces with little fear of contractile scar deformity, even in third-degree burns. In short, it has all the advantages and none of the disadvantages of all the other types of treatment.

The standard routine treatment suggested is as follows:

FIRST AID TREATMENT

(a) *Keep patient warm* by any means possible; blankets, coats, hot coffee, hot water bottles, etc. Place the patient out of the weather.

(b) *Relieve pain* by giving adequate doses of morphine, grain ⅛ to ½, every half hour if necessary.

(c) *Prevent loss of plasma* and plasma proteins by administering adequate amounts of adrenal cortical hormone (2 cc. dose), parenterally. Plasma infusions should be started.

(d) *Apply sulfadiazine (5 percent)—triethanolamine (8 percent)—stearin* ("lubricating jelly" may be used as a base) *ointment* to the otherwise undisturbed burned areas. No debridement is done. Apply a sterile dressing to protect the burned area.

(NOTE.—In the alternate method the triple-dye ointment made up of an aqueous solution of 2 percent crystal violent and brilliant green and a 0.2 percent acriflavine, in a "lubricating jelly" base, should be used for the first-aid treatment, instead of the sulfadiazine-triethanolamine ointment).

(e) *Remove the patient to a hospital* as soon as possible.

HOSPITAL TREATMENT

(a) Wrap the patient in a sterile sheet.

(b) Begin antishock therapy.

    1. Place the patient in Trendelenburg position.

    2. Apply heat cradle (90°).

    3. Plasma should be given; adrenal cortical extract should be routine.

    4. Give more morphine if indicated.

    5. Oxygen should be routinely administered by means of a Boothby mask.

(c) Give the tetanus-gas bacillus antitoxin (is the patient sensitive to horse serum?).

(d) Operator and assistants prepare themselves for a sterile operation.

(e) The patient is draped.

(f) If burn and other injuries are extensive and dirty, requiring cleansing as well as debridement or other surgical procedures, intravenous sodium pentothal should be administered.

(g) Debridement and *careful, gentle* cleansing is performed. Wash and irrigate with sterile saline. Dry with hair dryer.

(h) A solution of 3 percent sulfadiazine and 8 percent triethanolamine is sprayed on the burns.

(*i*) The patient is placed in bed. Shock therapy is continued (plasma and cor-tate are administered) until blood shows normal viscosity. (Check hemoglobin and R. B. C.) A heat cradle is kept over the patient. *Be careful;* shock may be delayed up to 10 and 20 hours after the initial burn.

(*j*) The burn is sprayed hourly the first day; every 2 hours the second day; every 3 hours the third day; and every 4 hours the fourth day. By this time the eschar is complete.

(NOTE: If the sulfadiazine-triethanolamine solution is not available then the triple-dye aqueous solution (1 percent crystal violet and brilliant green and 0.1 percent acriflavine) should be used to spray the burn. The spraying is done every hour for 8 hours.)

(*k*) Check blood and urine daily for sulfadiazine levels and crystals, respectively. Do not allow the former to go above 15 mg. percent.

(*l*) Observe the eschar daily. It is translucent and the tissues beneath are in clear view. If the burned surface beneath appears infected, remove the eschar with saline soaks, apply sterile saline spreads for a few days and then respray.

(*m*) When the eschar begins to loosen (about tenth day), warm saline immersions can be used to help loosen it. Do not remove a third degree burn eschar under 2 weeks. It is best to leave it *in situ* for 3 weeks.

(*n*) Encourage motion. Get the patient up and about as soon as possible; on the day of admission, if feasible. The soft eschar does not interfere with motion.

(*o*) If large denuded areas of granulation tissue remain after the eschar falls off, apply saline spreads for a few days and perform skin graft as soon as possible, to prevent disfiguring scars.

The triple-dye method can be substituted for the sulfadiazine-triethanolamine ointment and solution. It is almost as efficient, but is messy and has more tendency to cause disfiguring scars, although these are not as severe as in the tannic acid treatment. The dye method has an advantage in that it is more economical. Sulfadiazine is still a rather expensive drug; however the added cost is justified by the lowered incidence of morbidity, mortality, and deformities. The tannic acid treatment for burns should be discarded, for with the newer treatments this method has outlasted its usefulness.

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BURNS EN MASSE

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On December 7, 1941, there were received at the United States Naval Hospital, Pearl Harbor, following combat, 254 cases of burns. These were primarily flash burns from exploding bombs, oil burns, and preponderantly second-degree. There were many first-degree burns and a moderate number of combined second- and third-degree cases. There were no pure third-degree types. Of the cases seen, the vast majority were contaminated principally with fuel oil.

Surface coverage varied from small areas to almost complete body surface. In most instances, this was determined by the type and

FIGURE 1.—PATIENT REMOVED OUTER SHIRT AND WORE LIGHTWEIGHT UNDER-
SHIRT WITH SHORT SLEEVES. NOTE ARMS WERE BURNED TO EDGE OF SLEEVES.

FIGURE 2.—PATIENT REMOVED BOTH OUTER SHIRT AND UNDERSHIRT.
NOTE BURNS TO WAISTLINE.

FIGURE 3.—PATIENT REMOVED ALL CLOTHING EXCEPT SHORTS.   NOTE OUTLINE
OF BURNS TO AREA OF SHORTS.

quantity of clothes worn. Those sailors who were fully clothed had burns of the hands and face and singed hair (where no hats were worn); whereas those wearing regulation shorts and under-shirts with short sleeves (Navy issue light undershirts) were more severely burned (figure 1). Those men who were just wearing shorts and no shirts had severe burns of the back, abdomen, and chest, in addition to arm and leg lesions (figures 2 and 3). It was readily apparent to those of us who have followed these cases that shorts and short-sleeved shirts were well defined in the areas involved.

Shortly after the action started, casualties began to arrive at the hospital in large numbers in all available conveyances. Some patients were hysterical and emotional; others were depressed—both types ex-hibiting great anxiety. Many were in shock, some *in extremis;* most were in pain.

One group of doctors and nurses were immediately assigned to allaying pain through use of morphine by hypodermic injection. Inasmuch as too much time is lost in boiling tablets for each injec-tion, a solution of morphine (gr. ¼ to 1 cc.) was prepared and a tray of sterile hypodermics (in alcohol) made available for instant use. This technic was most efficacious. Inasmuch as immediate relief is desirable because of the emotional tension of the patients, and the fact that time is essential, the initial dose of morphine should be grain ½. In isolated cases where shock was severe, saline by intra-venous route was given.

All this work continued throughout the day and night and through the next day and night, working in relays. By the third day organization was accomplished along other lines. The serious, critical, and mild cases were segregated. Teams of corpsmen were rapidly trained to the debridement of wounds and to do minor dress-ings. They also forced oral fluids, changed beds, and arranged, insofar as possible, for the comfort of patients. Nurses arranged for charts, took census, and kept records of therapy. On the third day, two-thirds of the medical personnel, assisted by corpsmen who were trained solely for this work, started giving plasma to all patients who needed it. These were the majority of the casualties, and so this work continued day and night, even to the extent of working through the blackout with flashlights equipped with blue lenses. Due to extensive lesions, constriction and collapsing of superficial vessels, saline and glucose were administered concurrently. I should like to state that inasmuch as it is necessary to continue intravenous therapy over a considerable period of time, every effort should be made to conserve all available routes.

The importance of supplying plasma and fluids to burn cases must not be minimized. If there is an extensive burn, the loss of

plasma with consequent blood concentration, serum protein depletion, and reversal of albumin globulin ratios makes replacement essential. This was accomplished by the use of pooled human plasma obtained from local plasma banks. During the course of treatment, we also received some pure albumin fraction of human blood. This, too, was administered in selected severe cases.

After the fourth day, the laboratory proved invaluable in furnishing reports on the blood concentration as evidenced by cell pack, hemoglobin, serum protein, and albumin globulin ratios. These were a help in determining blood plasma requirements. Many patients who showed severe protein depletion received as much as 1,250 cc. of plasma a day. The majority, however, received in the neighborhood of 500 cc. A total of approximately 175,000 cc. of plasma was administered. This was supplemented by large amounts of saline and glucose.

For two days the supply of crystalline albumin, furnished us by Harvard University, was used in place of the pooled plasma (in selected cases) in an effort to determine relative values. This was done under the supervision of Drs. I. Ravdin and P. Long of the National Research Council, Washington, D. C., who brought the albumin with them by plane from the mainland. Due to the limited supply, we were unable to come to any definite conclusions as to its therapeutic value, despite extensive laboratory determinations run simultaneously with its use. If shown by further study that the albumin fraction is as efficacious in keeping up the total serum protein as a relative amount of plasma, it would be considered far superior to plasma because of ease of administration and smaller bulk.

During their stay at Pearl Harbor, Drs. Ravdin and Long offered a rule for the estimation of the amount of plasma required, on the basis of cell pack and total serum protein. In essence this was: 100 cc. of plasma is required for each point that the cell pack goes up, and 50 cc. additional for each 0.1 that the plasma protein goes down. While this is a very valid and undoubtedly a well-founded estimation, nevertheless it was impractical for use during treatment. There were three reasons for this: First, there were too many cases and it would have been impossible for any but a large laboratory staff to keep up with the amount of blood determinations required. Second, it would have entailed too much needed time to take all the bloods necessitated. Third, when under stress of many cases, fluids and plasma are given from the outset and this of course renders the blood dilute and so lowers the initial cell pack and hemoglobin values as well as varying the total serum protein, depending on the substance injected.

As to reactions, it was noted that there were none with the commercial dessicated plasma, a few with the human crystalline albumin, but many were observed after the use of pooled plasma. This took the form of violent chills that were controlled readily by the use of adrenalin and heat. The reasons that so many reactions were observed with the pooled plasma was quite evident. When the local banks began to collect blood to meet the unprecedented demands, the speed with which they worked caused many of the early specimens to contain some red blood cells and fibrin. As the work proceeded, the plasma specimens became better and better, and fewer reactions were encountered.

The other one-third of the medical officers personally took charge of the debridement and local dressings. Various local medications were used. These included: sulfanilamide powder; sulfanilamide in mineral oil spray, 8 percent; sulfathiazole suspension (sulfathiazole 20 gms., NaCl 9 gms); gentian violet spray (aqueous 2 percent) and boric acid wet dressings.

There being no authoritative criteria to be followed or absolute indications for the use of any specific local agent, experiments were conducted in an effort to gauge efficiency. Some cases were treated with one type, while others had a different local application; in some, the right side of the body was covered with one dressing in contradistinction to the left side.

In general, it was noted that when the eschar was removed from the extensive lesions, there was usually a local surface infection. This infection was due to contaminating influences prior to therapy. These cases were treated with dressings soaked in mineral oil and sulfanilamide, but after 2 days it was found that these dressings adhered to the raw surface and were difficult and painful to remove. Sulfanilamide spray was, therefore, substituted without the use of dressings. Many cases required no further variance in therapy. A few cases continued to show infection, and in these, continuous wet boric acid dressings were found to be efficacious after 48 hours. Then sulfanilamide powder was dusted on the clean denuded areas.

As mentioned above, in some cases one side of the body was treated with gentian violet on the denuded areas as against sulfathiazole suspension on the other. No appreciable difference was noted except that there was a little in favor of the gentian violet, in that the sulfathiazole suspension caked and cracked and the wound underneath looked no better.

Within the first 24 hours, heat cradles were manufactured and made available. At night, during black-outs, these were kept going by the use of blue light globes. Bedding was protected from fire by the use of asbestos square plaques over the globe and under the bedding.

After 3 or 4 days following admission, some of the cases developed a temperature. This was considered to be due to local infection, and, therefore, chemotherapy was instituted. Sulfathiazole and sulfadiazine, orally, in the customary doses, usually controlled this in 48 to 72 hours.

After 10 to 12 days of intravenous therapy, some patients developed an apparent anemia which was due to continued blood dilution by intravenous fluid administration. In some 'cases we thought the anemia to be real as well as apparent. These patients were given whole citrated blood with marked improvement in all cases and repeated as often as required.

During convalescence, vitamin C was administered because of the realization that there was a lowered blood content due to the burn. Vitamin B_1 also was used and high-protein diets for tissue replacement.

Of the burn cases admitted, approximately 14.8 percent died within the first 36 hours, and about 10 percent died within the first 12 hours. Due to the rapidity of admissions and the speed at which we worked, the number of deaths for the first 36 hours had to be approximated, and some of them were not taken up on the hospital roster.

	Percent
The percentage of death to total admissions	25. 5
Corrected for those that died in first 12 hours	16. 7
Corrected for those that died in first 36 hours	12. 5

Of the cases that were alive after the first 36 hours, there were nearly one-half in a serious condition, with from 40 to 70 percent of the total skin surface burned to a second or third degree. Of these serious condition cases, the death rate was about 30 percent. Although this mortality rate seems high, it must be remembered that all of these cases were seriously burned; and it must, also, be remembered that even with ideal therapy there will always be a mortality of 15 to 20 percent in severely burned cases.

Repeated urinalyses on all patients showed renal damage in very few cases, and this was not marked. We realize that it is too early to express an opinion in this respect as yet.

Those of us who treated these cases are cognizant of the fact that initial precise laboratory determinations and early intense plasma administration were not used, but under the circumstances in which we worked, we feel that excellent results were obtained. We are convinced that the former dictum of one-third to one-half of the body surface burned is definitely not a true prognostic gauge. We had many recoveries where vast areas were involved by second-degree burns.

It is somewhat difficult to comment on the therapy as employed during and following the raid, but certain facts stand out and certain lessons were learned.

It was evident that where an extensive burn is encountered, the sooner plasma is administered, the better the chance of recovery. Plasma is needed in large amounts daily in severe cases. It is also true that where an extensive burn exists there are left few routes for intravenous administration and one should be very careful to conserve these. Even when veins are no longer visible or palpable, plasma must be given. We did not hesitate to use the femoral veins, which in most cases were easy to find, first, because of anatomical knowledge of location (being median to the artery, which is palpable) and second, because the skin in this area was normal in almost all cases because the men had on some sort of protective clothing.

Although the primary need of these patients is plasma, nevertheless the continued dilution evidences a secondary anemia which requires whole blood for adequate replacement. While blood banks are busy centrifuging blood for plasma, wouldn't it be possible, let us say after the seventh to tenth day of emergency conditions, to type, citrate, and pool some whole blood for administration to these patients?

Certain principles in local therapy were also manifest. These patients are losing plasma through moist wounds and, therefore, it is necessary to hinder this loss as far as possible. Therefore, after debridement the local dressing should be of such a nature that it forms a dry eschar. When this happens, the eschar should be left alone except that a small area underneath should be inspected daily to determine if there is any surface infection and whether or not the area beneath is dry and healing.

Where surface infection is evident, the local application of the sulfonamide powders, having proved efficacious, should be continued. Since this was so, we wondered whether or not the dose for internal administration could not be lowered, hence removing another possible etiologic factor in producing secondary anemia.

There were four suggestions that became manifest as the work progressed:

1. An increased supply of plasma should be carried on all ships and stations throughout the Navy. These supplies should be available and handy to first-aid stations, and along with them there should be an ample supply of simple, sterile set-ups for rapid use.

2. Men aboard ship or in places of danger should be fully clothed and abbreviated uniforms should be done away with.

3. Heat cradles with necessary electrical equipment and asbestos protection for the bed linen, should be kept on hand for emergency use.

4. Spray guns should be kept on hand because extensive local applications are applied more rapidly, more evenly, and with less pain than by the paint method.

INDOCTRINATION OF AVIATION PERSONNEL IN USE OF OXYGEN EQUIPMENT IN A LOW-PRESSURE CHAMBER

By Lieutenant Commander Chalmers L. Gemmill, Medical Corps, United States Naval Reserve

Realizing the need for training of aviation personnel in the use of oxygen equipment and in high altitude flying, the Division of Medical Research in the Bureau of Aeronautics sponsored a plan to place a low-pressure chamber in each of the primary training bases. This plan has been carried out and the indoctrination of 2,521 students in the chamber at Pensacola has been made. This report will give the results of these student runs.

PERSONNEL

In order to train a team of men to start the indoctrination in the chamber, two medical officers, a pharmacist's mate and a water tender were sent for a short course of instruction in low-pressure chamber work at the experimental diving unit, Navy Yard, Washington, D. C., and at the School of Hygiene, Boston, Mass. Following their return to Pensacola, a course of instruction by this trained group was given to a similar group from other training bases. It was this original group that started instruction of cadets at Pensacola. At the present time, all of the regular medical officers attending the School of Aviation Medicine at Pensacola are trained as aides in the low-pressure chamber, and several of these men have had special training while waiting for their orders. There is now a permanent staff of six reserve medical officers who, by special training in clinical sciences, make an ideal group for the continuation of this work. In addition, the designation of low-pressure chamber technician was given to four pharmacist's mates who have spent considerable time in this work. In fact, three of these men have worked in the low-pressure chamber at the Public Health Service at Washington for more than a year. One additional pharmacist's mate has been given the designation and four are under training.

The personnel problem will be ever present in the use of these chambers. It is impossible for two or three medical officers to satisfactorily operate a low-pressure chamber. To be constantly exposed to decreased barometric pressure with the concomitant expansion of the intestinal tract, and with the danger of ear and sinus involvement, is a serious risk. Therefore, in the stations in which there are low-pressure chambers as many medical officers and pharmacist's

mates as possible should be trained to make the runs. The doctors will see numerous reactions to anoxia, the use of oxygen equipment, and the causes of failure of oxygen equipment which will be valuable to them as flight surgeons. It is of special interest for medical officers under instruction in the School of Aviation Medicine at Pensacola to receive this training for they are much better equipped to handle these problems as a result.

OXYGEN INDOCTRINATION

The plan of indoctrination has three general objects in view:

1. To instruct students in the use of oxygen equipment.
2. To enable them to recognize the dangers of anoxia.
3. To observe how oxygen relieves the signs and symptoms of anoxia and enables an aviator to reach higher altitudes than is possible without extra oxygen.

These 3 objects are achieved in the following manner: The students receive three 1-hour lectures before coming to the chamber. The first lecture covers the essential features of respiration; the second lecture gives the physiological reactions to anoxia; while the third covers the construction and design of the oxygen equipment. Following these lectures the students are divided into groups of 10. These groups report at 0630, 0830, and 1130. On reporting to the oxygen indoctrination unit, the students are again given a half hour lecture on the use of oxygen equipment and are assigned seats in the chamber. They are given a simple psychological test at sea level, pulse rates are taken, the doors are closed, and the run started. They ascend at the rate of 4,000 feet per minute. They remain at 18,000 feet without extra oxygen for 10 minutes. Another psychological test is given them. Then they put on their masks and start taking oxygen. Following this, they are taken to an altitude of 28,000 feet, at which they are given a third test. They descend at the rate of 2,000 feet per minute.

ANOXIA

It was noticed that of the 2,521 students indoctrinated, 208 needed oxygen before the end of the 18,000-foot period (15 minutes). Of these 34 lost consciousness. In some of the latter, the loss of consciousness was very sudden, in others it was gradual, with marked cyanosis and pallor. A few had convulsions. The 174 men needing oxygen, but not fainting, were given oxygen for either, or both, of two reasons:

1. The observer noticed gradual deterioration characterized by slow reactions, marked cyanosis, and incoordination.
2. The man stated that he felt faint, dizzy, and weak.

In all except one individual, recovery was rapid when oxygen was administered. In this man, there was such marked perspiration, weakness, and bradycardia that he was sent to the dispensary. He remained in bed overnight. A history was taken of each man who failed in an effort to try to find some factor in his background which might have contributed to the failure. These histories will form a basis for a future report.

The majority of the students get a low score on the psychological test in contrast to good scores at sea level and at 28,000 feet. This lowering of their score is used to emphasize the psychological change which occurs at high altitudes. The pulse rate increases at 18,000 feet when the subject does not receive extra oxygen and returns to the sea level value when oxygen is administered. The results are recorded on the blackboard in the chamber. The medical officer uses this rise in pulse rate to instruct the student concerning the extra strain on his heart when he attempts to fly to a high altitude without using his oxygen equipment.

EARACHE

The question of earache is a very important one in low-pressure chamber work. Three hundred and five of the two thousand five hundred twenty-one students complained of earache in these runs. In that group there were only two who had earache on ascent. A preliminary drop of 3,000 feet is made following the ascent to 5,000 feet in order to ascertain if the men can stand descent. This test does produce a few earaches and the individuals suffering from these pains are removed from the chamber. The majority of earaches occur from 17,000 to 14,000 feet on the descent. This indicates that an 11,000-foot drop is necessary to elicit pain. One individual did complain of pain at 22,000 feet on the descent. The cure for earache is to stop the run and to ascend 1,000 feet. One method of prevention is elimination of those who have had recent colds, sinus infection, and sore throats. A quick examination is made of the cases who give a history of any of these conditions. Another method of prevention is to instruct the men in the chamber to stretch their jaw muscles every 400 feet on the descent. No permanent damage was ever observed.

SINUS PAINS

Forty-two men had sinus pains. These pains were all frontal sinus pains and all occurred on the descent. The onset is generally sudden. In a few cases the pain was very severe. The best method of relief is a quick ascent of 1,000 or more feet.

TOOTHACHE

Sixteen complaints of toothache were received. All of these cases were sent to the dental department for examination. Several abscesses were discovered and the infected teeth were removed.

SUMMARY

A discussion is given of student indoctrination runs in the low pressure chamber at the Naval Air Station, Pensacola, Florida. A numerical analysis of the cadets suffering from anoxia, earache, sinus pains, and toothache is given.

HEART DISEASE IN MIDDLE AGE

By Lieutenant Commander Christopher C. Shaw, Medical Corps, United States Naval Reserve

It has been said that "life begins at forty" but it might better be said that "life begins to go downhill at forty," for heart disease resulting from degenerative changes in the cardiovascular system is the most common, single cause of death and disability in the middle-age group between 40 and 65 years (1). Disorders of the cardiovascular system which occur during middle life may be classified under three main headings:

1. Heart disease caused by infectious agents.
2. Heart failure resulting from metabolic and endocrine dyscrasias.
3. Cardiovascular disorders due to degenerative processes.

Within the first division one finds lesions of the cardiovascular system resulting from typhoid fever, syphilis, diphtheria, scarlet fever, bacterial endocarditis, glomerulonephritis, pyelonephritis, tuberculosis, and lead poisoning.

Of these infectious diseases involving the heart and blood vessels during middle age, syphilis is of prime importance. The spirochaeta pallida attacks the myocardium and aorta and larger arteries in the general systemic invasion which follows shortly after the initial lesion, or chancre, appears. The organisms are distributed throughout the body and remain quiescent in the cardiovascular tissues during the long period of latency which precedes the onset of tertiary syphilis. When the signs and symptoms of cardiovascular lues appear they may develop with almost explosive violence.

The pathology in the myocardium consists of either a diffuse inflammatory involvement of cardiac muscle tissue with progressive congestive failure or the development of gummata with destruction of the intrinsic nervous pathways and subsequent arrhythmia, often

in the form of heart block. The diffuse myocarditis alone may be a cause of sudden death in middle age (2).

Invasion of the arterial tree by the spirochete of lues centers about the root of the aorta and begins as an obliterating arteritis of the vasa vasorum with subsequent necrosis and degeneration of the media of the aorta (a mesaortitis). This process continues and may cause formation of an aneurysm, or produce insufficiency of the aortic valve, or encroach upon the ostia of the coronary arteries which arise in the sinuses of Valsalva.

Aneurysmal dilation of the aorta may be either saccular or fusiform but in either case places practically no burden on the heart. Aneurysms cause symptoms only when they erode bone—ribs, vertebrae or sternum—or impinge upon vital structures in the mediastinum. Their presence, however, is a harbinger of death due to the danger of rupture with sudden exsanguination, or the possibility of slow hemorrhage from necrosis and perforation of the aneurysmal wall. Insufficiency of the aortic valve and coronary stenosis produce typical clinical syndromes and require no further elaboration at this point.

Unfortunately for the patient and for the clinician, cardiovascular syphilis frequently develops in the presence of a negative Wassermann so that the diagnosis (and treatment) cannot be established by serologic tests. This probably occurs in 15 percent to 20 percent of luetic patients with cardiovascular syphilis, and is most likely the result of inadequate therapy during the primary and secondary stages of the disease. The treatment received was sufficient to reverse the positive Wassermann at that time but insufficient to prevent the development of cardiovascular involvement 10 to 20 years later, in spite of the fact that the patient's blood serology continued negative. In such instances, the doctor must lay great stress on the history of venereal infection and specific antiluetic therapy in youth and not be guided too strongly by repeatedly negative blood reports during middle age. Treatment should be directed toward alleviation of the congestive failure first, and then supplemented by careful administration of spirocheticidal drugs. The prognosis is poor in any form of cardiovascular syphilis.

With the exception of disease of the thyroid gland, metabolic and endocrine disturbances such as gout, obesity, pituitary, and adrenal tumors are relatively rare in older pilots and for this reason will not be considered in this discussion. Thyrotoxicosis, however, produces certain disturbances in the circulation which are worthy of comment.

The increase in metabolism due to an altered or toxic secretion of the thyroid hormone whips up the general circulation, causes slight peripheral dilatation, and increases the pulse pressure. The metab-

olism of the heart muscle itself is also elevated and results in a marked rise in the pulse rate with proportional decrease in the length of the diastolic phase of the cardiac cycle. The combination of these factors throws a tremendous load on the myocardium which will eventually show signs of congestive failure unless and until the toxic secretion is reduced by administration of iodine and then ablated by subtotal thyroidectomy.

In deficiency of the thyroid gland the patient becomes myxedematous, and as a result of the lowered metabolism the myocardium becomes soft and flabby and sluggish and unable to maintain an adequate circulation. Congestive failure will result but can be promptly mended by administration of thyroid extract by mouth. The basal metabolic rate is an index of diagnosis and of adequate thyroid medication in such cases. Sudden cardiac death has been reported in untreated myxedematous patients (2).

Finally, mention must be made of the importance of masked hyperthyroidism in heart disease (3). This possibility should be borne in mind in all cases of congestive failure which fail to respond to bed rest and adequate doses of digitalis. Such patients often exhibit transient auricular fibrillation, nervousness, loss of weight, tremors, and excessive perspiration and yet they present no exophthalmos nor enlargement of the thyroid gland. Blood pressure readings, pulse pressure, and pulse rate are frequently found to be within normal limits in spite of the dyspnea, cyanosis, and edema which alarm the patient and confuse the physician. Low-grade glycosuria and mild diarrhea may also be present.

The basal metabolic rate in such cases will be elevated to +30 or even to +70 and will determine the true cause of the failure of the heart (3). When masked hyperthyroidism is engrafted upon a heart already embarrassed by previous disease—rheumatic fever with mitral stenosis or coronary occlusion with infarction—the differential diagnosis requires clinical acumen of a high order. The first syndrome may dovetail into and almost completely obscure the second. When the two conditions are found to coexist—based on repeated basal metabolic rate determinations—treatment should be directed toward the control and removal of the "masked" thyrotoxicosis.

By far the largest and most difficult field of heart disease in middle life comes under the heading of the "degenerative processes." This is especially true since the exact cause, or causes, of vascular degeneration are not known. However, because of the magnitude and importance of the problem, a short review of the salient points may not be amiss, even though our present knowledge of the subject is far from complete.

Degenerative diseases of the cardiovascular system include arterio-sclerosis, coronary disease and angina pectoris, hypertension, and hypertensive heart disease. In this same category most authors include *cor pulmonale* and chronic nonvalvular heart disease, or chronic myocarditis.

Recent studies indicate that the underlying factors in all these degenerative states are heredity and the wear and tear of existence caused by the physical, mental, and nervous strains of living and making a living in the twentieth century. The adage, "a man is as old as he feels," might be more truthfully paraphrased to read, "a man is as old as his arteries," that is, as old as the quality and function of his vascular tree inherited from his ancestors.

At the present writing, medicine has no control over heredity, although it is constantly striving to patch up inherited defects. By the same token, little can be done to control the speed of modern living or to lessen the wear and tear on the cardiovascular system incident to high-speed flying in modern military aviation. Both the strain and the stress are plunging forward at relatively increasing velocities and show no immediate evidence of reaching a reasonable equilibrium. And the cardiovascular system pays the piper in the long run. Sometimes the nervous system goes bankrupt first; but even in this case, the scars of battle have already left their indelible mark on the heart and blood vessels.

The most frequent "mark" is the atheromatous plaque of arterio-sclerosis which is a manifestation of senescence of vascular tissue. The underlying cause probably will be found in a faulty metabolism of cholesterol, as it has been shown that the cholesterol content of the thoracic aorta increases with age (4). This degenerative process termed "atherosclerosis" may be general in distribution involving all the arteries of the body from the largest to the very smallest, or it may be localized in one or more specific areas such as the brain, the coronary vessels of the heart, or in the kidneys.

As the vascular degeneration progresses, there develops a relative ischemia of the tissue supplied by the atherosclerotic vessel. If the process is gradual, a more or less efficient collateral circulation may be established which will serve to mask for a time the insidious and progressive nature of the atheromatosis. On the other hand if the diminution of blood flow to a part or organ be sudden or complete, as in thrombus formation over an ulcerated sclerotic plaque or in fracture of a calcified atheroma with embolic phenomenon, then infarction of the tissue peripheral to the sudden occlusion results. In either instance the end picture is primarily a diffuse or localized fibrosis of the parenchyma.

Vascular degeneration in the brain caused by atherosclerosis gives rise to the signs and symptoms of cerebral arteriosclerosis. In the kidney the disease may remain quiescent until the rather sudden onset of marked renal impairment or progressive renal insufficiency appears (2). Arteriosclerosis of the vessels supplying the pancreas gives rise to a true diabetes which is usually comparatively mild. In the extremities the process produces causalgia and intermittent claudication. Thrombosis and/or embolism, rapidly lead to gangrene.

Arteriosclerotic aortitis is usually symptomless until the process invades the ring of the aortic valve causing stenosis, or unless the coronary ostia in the sinuses of Valsalva are impinged upon by atherosclerotic plaques. An aneurysm of the aorta due to arteriosclerosis may be a simple, diffuse, silent dilatation or it may occur as the dissecting type which is spectacular, excruciatingly painful, and usually causes sudden death from shock or from rupture of the aorta in a few hours or days after the sudden and dramatic onset of the dissection of the media.

Atheromatosis of the coronary vessels leads to coronary insufficiency and occlusion with impaired cardiac efficiency due to myocardial ischemia and infarction. In this connection it is interesting to point out that coronary occlusion *per se* does not necessarily produce any characteristic clinical manifestation (5).

If the occlusion develops very gradually (as it may in atherosclerosis), nature will improve the opportunity to develop or expand the potential collateral circulation in the heart muscle and produce anastomoses sufficient to prevent, or circumvent, infarction of the myocardium. This is brought about by opening of the Thebesian capillaries coursing within the muscle bundles and by the propagation of vessels from the circulation of the pericardium at its attachment near the base of the heart.

The extent and efficiency of this collateral circulation has not been generally realized but its importance is evidenced by the fact that it is found operative in approximately one-fourth of the patients with coronary occlusion (1). Their lives have been prolonged for years and they may have remained symptomless because of the very chronicity of their vascular degeneration. At postmortem examination extensive atherosclerosis of the coronary vessels may be present out of all proportion to the clinical manifestations (6). Cases are on record in which one or both coronary arteries have been found completely occluded at autopsy, yet the patient remained free of symptoms referable to the heart during life and succumbed from noncardiac causes (1).

If on the other hand the occlusion occurs rapidly, the classical picture of myocardial infarction develops. This is characterized by

substernal pain and oppression due to anoxia of the infarcted area of heart muscle (7). There is concomitant fall in blood pressure, pallor, shock, fever, leukocytosis, pericardial friction rub and typical electrocardiographic changes. In such cases the clinical diagnosis is usually coronary thrombosis, but the term "myocardial infarction" would be more accurate.

Pain is commonly an outstanding symptom of this syndrome and frequently is crushing or grinding in severity and of prolonged duration. In other cases pain may be notable by its absence, since there are certain areas along the lateral wall of the left ventricle which are relatively silent as far as symptoms and signs and electrocardiographic evidence of infarction are concerned. Many cases of painless myocardial infarction have been recorded in which the only complaints were sudden dyspnea and progressive congestive failure (8).

Sclerosis of the peripheral vessels is not a true cause of heart failure for it has been shown that extreme degrees of peripheral arteriosclerosis have no deleterious effect on cardiac function (3); nor is there necessarily any relationship between peripheral and coronary vascular degeneration. The former may exist in the entire absence of the latter, and, conversely, coronary atheromatosis may be present to the point of death and show no evidence of narrowing or tortuosity or induration of the peripheral arteries, nor of the retinal vessels in the fundi. The term "arteriosclerotic heart disease" is, in a sense, a misnomer and should be dropped in favor of the more truly descriptive phrase "coronary artery heart disease" (3).

Angina pectoris manifested by substernal or precordial pain of agonizing character and short duration is a symptom-complex and not a disease entity. It is the consensus that it results from anoxia of the heart muscle (7)—in other words, a cardiac "cramp"—which may be brought about by angiospasm or by partial occlusion of a coronary artery or one of its branches. Vasospasm occurs in about 10 percent of patients suffering with angina and is induced by hypersensitive nervous mechanisms, by thyrotoxicosis, by ingestion of certain poisons and by excessive inhalation of nicotine. Coronary thrombosis with anginoid pain is three times more prevalent in heavy smokers than in non-smokers during middle age (1). In 90 percent of the cases diagnosed "angina pectoris," degenerative disease of the coronary arteries can be demonstrated.

A word of caution in regard to the close association between arteriosclerosis and hypertension. It is definitely accepted that arteriosclerosis does not produce hypertension. Hardening of the peripheral vessels alone is conducive to hypotension rather than high

blood pressure since the elastic recoil of the arterial wall is greatly reduced by atheromatous infiltration of the intima. Arteriosclerosis may, therefore, exist for years without any rise of blood pressure. On the other hand, hypertension cannot be present for long without producing degenerative changes in the vascular tree. Hence it is difficult to say whether the high blood pressure caused the arteriosclerosis or whether the unknown cause, or causes, of the hyperpiesis exerted a concomitant deleterious effect on or within the intima of the blood vessels.

Be that as it may, the actual cause of hypertension still remains a mystery. Numerous theories have been applied to the problem but all have been found wanting. The most rational hypothesis deals with the irritability of the arterioles causing vasospastic constriction which produces a proportional increase in peripheral resistance and this in turn necessitates an increase in hydrostatic force—that is, an elevation of the blood pressure—to cope with the augmented or heightened resistance in the peripheral circulation.

During the past decade considerable experimental work has been done on this problem and it has been shown repeatedly that experimental hypertension can be produced by renal ischemia (9) (10) (11) (12). Furthermore, this rise in blood pressure (produced experimentally) is of humoral origin and arises as a result of the presence of an excessive amount of pressor substance in the circulation. This pressor substance is not actually produced in the ischemic kidney but rather is a combination of a precursor (renin) liberated by the damaged kidney and an activator (angiotonin) already in the blood (13). Moreover, this pressor substance (hypertension) acts directly on the arterioles to produce vasoconstriction. The clinical application of this recently acquired knowledge is, like prosperity, probably "just around the corner." In the meantime the clinical problem of hypertension—both the benign and the malignant type— continues to baffle the internist.

A confusion of tongues has arisen in the matter of nomenclature. The terms "malignant sclerosis," "malignant hypertension," and the "malignant phase of essential hypertension" all refer to the same syndrome. High blood pressure is not a disease entity but rather a symptom-complex in which the hypertension is either primary (essential) or secondary to any one or any combination of a number of different diseases. This concept is not generally entertained but its validity is attested clinically by the fact that in the long run the *modus operandi* of every case of hyperpiesis is identical, no matter what its pathogenesis is or may have been. The malignant phase frequently develops after hypertension in the benign form has been present for a variable length of time, perhaps even unsuspected.

In a small percentage of patients hyperpiesis may apparently be malignant from its onset. This is termed the *de novo* form of the disease and may occur explosively in certain cases of primary hypertension or develop quite dramatically in patients who for many years have suffered from latent renal disease without any previous increase in their blood pressure (14).

The onset of the malignant phase of hypertension (be it "primary" or "secondary") is characterized by severe headache, visual disturbances, vomiting, anorexia, cachexia, and exhaustion. These signs and symptoms in the presence of a systolic pressure bordering on 200 mm. Hg. and a diastolic pressure in the neighborhood of 110 mm. Hg., or higher, predict a progressively rapid failure of the cardiac or renal functions. Patients with hypertension are all potential cardiacs or nephritics. Their clinical course is downhill (rapid in the essential or malignant type; slow in the benign or secondary form) and almost always terminates fatally in cardiac failure, or in apoplexy, or in uremia.

Patients suffering and dying from hypertension, or the effects thereof, can be segregated into several well-defined etiological and pathological groups, depending on the pathogenesis of their underlying disease, as follows (14) :

1. Primary or essential hypertension (cause, or causes, still in doubt).
2. Secondary hypertension due to—
   A. Renal disease :
      a. Glomerulonephritis.
      b. Pyelonephritis.
      c. Intercapillary glomerulosclerosis.
      d. Congenital unilateral hypoplasia.
      e. Obstruction of renal artery by atherosclerotic plaque.
      f. Multiple occlusions of small renal arteries.
      g. Renal infarct.
      h. Periarteritis nodosa of renal vessels.
      i. Polycystic kidneys.
   B. Chronic lead poisoning.
   C. Polycythemia vera ; leukemia.
   D. Endocrine disease.
      a. Pituitary—basophilic adenoma.
      b. Adrenal—hypernephroma ; paraganglionoma.
      c. Thyroid—thyrotoxicosis.
      d. Hyperemesis gravidarum.

Time and space do not permit further elaboration of the factors listed in the table. During life it is usually impossible to tell whether the patient is suffering from hypertension which is primary unto itself or is secondary to some unrecognized morbid lesion. Whatever the nature of the underlying pathological process, the prognosis is poor either in the long or the short run. Treatment is purely palliative except in those rare cases where the renal or glandu-

lar pathology is amenable to surgery. The results of sympathetic surgery in patients with the malignant form of hypertension have been uniformly disappointing (15).

The term *cor pulmonale* refers to failure of the right ventricle as a result of increased pressure in the pulmonary circuit. This may occur in the acute form following a large pulmonary embolus but more frequently is a chronic affair as seen in emphysema, silicosis, stenosis of the pulmonary artery, and in extensive fibrotic tuberculosis, or in spontaneous pneumothorax (especially when bilateral). These conditions, when they do develop, usually appear during middle life (2).

Cardiac disease caused by avitaminosis and dietary deficiencies, such as protein starvation, is rare in this country but is a possibility among the civil population during war time. Myocardial failure due to the presence of a peripheral arteriovenous fistula—the traumatic variety should present no diagnostic difficulty—to tumors of the heart muscle and to deformities of the spine and thoracic cage are so rare that they will practically never enter the physical picture of the aviator approaching middle age.

There is one form of chronic myocardial insufficiency, however, which deserves mention because its etiology is not clear, because it is frequently overlooked, and because its onset is insidious and its course progressive.

This is a nonvalvular cardiopathy characterized by congestive failure of unknown cause. Clinically, there is no evidence of hyperthyroidism or emphysema or avitaminosis or protein deficiency or blood dyscrasia. Neither are there any signs or symptoms of infection of the endocardium, myocardium, or pericardium. Nor can vascular degeneration nor hypertension be indicted — and yet the myocardium tires out during middle age, either early or late, and runs down like an alarm clock and stops.

At autopsy, the heart is found to be both dilated and hypertrophied, but the heart muscle otherwise appears normal, to all intents and purposes. For lack of a better name such cases have been termed "chronic myocarditis," which is another misnomer since no inflammation of the myocardium can be found. The term "chronic myocardosis" has been suggested (16) to account for the dyspena on exertion, the flatulence after meals, and the mild precordial pain (transient but recurrent) which warn of impending congestive failure. These symptoms, however, are quite frequently found in many cardiac syndromes and should not be assigned (or consigned) solely to chronic myocardosis. It may be more satisfactory to designate this symptom-complex by the term "nonvalvular heart disease," or simply "chronic myocardial insufficiency".

Since heart disease is so prevalent and ubiquitous in middle life and since it is the most frequent cause of death and disability between the ages of 40 and 65 years, its prevention and early detection are of paramount importance. This is especially true for the profession of aviation, for while it is significant that anoxia causes a rise in blood pressure and pulse rate equivalent to that produced by mild exercise only, it has been realized more recently that the chronic stresses of flying eventually induce a generalized (and rapid) deterioration of the cardiovascular system (17).

In most instances this premise applies, not only for the aviator, but for the entire personnel of the Navy. In the past 20 years, the Bureau of Medicine and Surgery has recorded an alarming increase in coronary disease. The age incidence in these coronary deaths is lowering year by year and the morbidity is getting higher (18). McIntire (18) states:

Are we crowding our officers to a point where the cardiovascular system can no longer carry its load, or are we piling on so much responsibility that the nervous system cannot maintain its stability? * * * In the Navy a man must be physically fit to perform his duties at all times, in all places and under any condition. * * * It is the duty of the internist to find means of preventing disabilities, especially those due to degenerative disease.

While the call to duty in this respect is clear, the means of fulfilling this phase of our mission still remain obscure. This, in part, may be due to the fact that many of the methods and instrumentalities of modern cardiology lack precision. Some of the problems in this field of internal medicine yield only to empirical solution—or remain unsolved. Others are forced to rely for an answer almost entirely on the patient's history, which may be accurate and intelligent, yet incomplete; or it may be inaccurate and, therefore, worthless. Many of the signs and symptoms are transient; others notoriously absent when needed most to clarify the diagnosis. Even our present laboratory methods are far from infallible. Much must still be taken (and given) "on faith."

Pending that happy day when detection, recognition, prevention, treatment and after-care of the patient with degenerative cardiovascular disease shall reach a more rational (and simpler) plane, we must use our present scanty knowledge of the problem to the best possible advantage. Many time-honored procedures have proved their worth and have behind them the authority of regulations; other and newer concepts and diagnostic methods deserve consideration and fair trial.

Determination of the fitness of the cardiovascular system for continued military service is difficult because the examiner must rely chiefly on signs alone, and often these signs are of questionable significance. Tachycardia, systolic murmurs, slight elevation of

blood pressure may attract the attention of the examining physician. Usually these findings are of no particular importance, yet their presence demands careful investigation. Is the tachycardia due to nervousness or to the presence of a "hidden" infection (notably tuberculosis)? Is the elevation of blood pressure relative or absolute? Is it a precursor of essential hypertension? Does poor response to exercise indicate an impending effort syndrome? How can these questions—and a host of others—be answered unequivocally?

In an attempt to arrive at a reliable evaluation of the cardiovascular system of the middle-aged flier one must first have a baseline on which to "base" his judgment. This may date back to the general physical examination at the time of his enrollment or commission (19). In addition to the routine Schneider test and examination of the ocular fundi, an electrocardiogram and teleroentgenogram of the heart would be desirable. The cold pressor test and "circulation time" may provide important information on the "tone" of the peripheral vascular tree. Annual fluoroscopic examination of the heart and aorta and routine electrocardiogram every year after the age of 40 may some day be included in the Manual of the Medical Department.

In regard to the strain of modern living and the extra stresses placed upon the heart and blood vessels by commercial and especially by military aviation, little can be offered other than education and advice concerning the value of rest and the art of relaxation while off duty. Excessive indulgence in alcohol, tobacco, and other forms of dissipation are no respecters of persons or occupations. Such habits probably hasten the onset and speed the progress of degenerative diseases of both the cardiovascular and nervous systems.

The personnel of our armed forces who are approaching middle age must learn to acknowledge and respect their physical and nervous limitations. To grow old gracefully and graciously still remains an art which is worthy of cultivation and patronage. By so doing, our officers and men will be enabled to render better service to our country and live longer, more useful, and happier lives.

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OCULAR DOMINANCE AND MARKSMANSHIP [1]

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One day last spring two recruits came with the same complaint: "difficulty in seeing with the right eye." The visual acuity in each eye was normal, but they apparently had trouble in sighting at the rifle-range due to left-eye dominance. Among the line officers, I found that some expert marksmen were left-eyed, but remembered some difficulty in their early training. The present influx of recruits permitted a systematic study of the influence of eye dominance on marksmanship among men without previous shooting experience.

EYE AND HAND

One's master eye is more or less associated with his hand preference and cerebral dominance. In the evolutionary perspective handedness seems to have developed first. The anthropoid ape uses either hand indifferently, and not until the bronze age did early man

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[1] Read before the Chicago Ophthalmological Society, February 16, 1942.

show much evidence of hand preference. As tasks became more complex our progenitors learned that skills were more readily attained when one hand was exercised in the more delicate and responsible manipulations. That this honor became generally assigned to the right hand is not unlikely a survival of sun-worship symbolism (1). As man, who probably originated in the northern hemisphere, faced the East where the mighty Sun rose, his right hand followed the lordly course of the orb through the southern heaven. Thus the right hand became the righteous hand. The value of uniform handedness was apparent even to primitive military organizations. The Kaffir consequently scalded a child's left hand if over-active so that the youngster would be obliged to train the hand that received general sanction. It is interesting that, in infancy, hand preference and binocular fixation are first manifest at about the sixth month, and both become fairly well established at the age of 1 year.

According to the criteria used, the prevalence of left-handedness has been estimated at 3 to 30 percent of the general population. The divergence arises from the cases of natural left-handedness that have been more or less modified by early training. Various studies reveal the surprising extent of latent sinistrality. Robinson (2) noted that in museums about 75 percent of the visitors bear to the right, about 25 percent to the left. Wile (1) observed that umbrellas, when opened, were held in the right hand by 80 percent, and when closed were carried in the left hand by 70 percent. A survey of left-eye dominance by Parson (3) disclosed 29.7 percent; by Mills (4), 20 percent—a significant proportion since in acquired dextrality the left eye still remains dominant. From these data in which latent sinistrality averages 25 percent Mills and Wile conclude that left dominance is probably a Mendelian characteristic.

OCULAR DOMINANCE

With suitable tests ocular dominance is almost universally demonstrable. In the alinement test, popularized by Rosenbach (10) in 1903, the person examined, keeping both eyes open, holds a pencil vertically at arm's length and lines it up with some distant object. The examiner then occludes each eye in turn, and the eye that best maintains the alinement is considered the master eye. Curiously the prevalence of right eye dominance had been noted as early as 1593 by Baptista Porta (5). He wrote: "If anyone places a staff before him and brings it directly opposite some crack that exists in the opposite wall, and notes the place, when he closes his left eye he will not see the staff removed from the opposite crack, the reason being that every one looks with his right eye, as he uses his right hand."

The alinement method is only one of the many procedures avail-

able (6). The peep-hole test, first described by Durand and Gould (7) and now used in the physical examination of Navy aviators, was the most convenient for my investigation. With both eyes open the recruit sighted a distant flag through a hole in a cardboard sheet held at arm's length with both hands. If occluding the right eye blocked the view, the recruit was right-eyed; and vice versa.

After ocular dominance is established in an individual it is seldom reversed. Subsequent training of the nondominant eye, as in the use of the microscope, has no effect. The dominance will be maintained even with a deterioration of visual acuity providing it remains above 6/20. Hence the dominant eye not infrequently is that with the poorer visual acuity.

In binocular vision the line of direction is apparently referred to a center localized at a certain depth within the head and slightly towards the side of the master eye. For this reason, in the absence of guilding landmarks one walks, rows, or swims in a circle, bearing to the right or left according to the ocular dominance.

PRESENT INVESTIGATION

In the present investigation 16 companies of untrained recruits, totaling 1,768 men, were examined at a 200-yard course. The men were scored for 10 shots each at prone slow fire, sitting slow fire, and prone timed firing (10 shots in 1 minute). With a bull's-eye counting 5, the maximum score possible for each position was 50. Along each man's name on the muster sheet, the hospital corpsman on duty noted his experience, hand preference, and ocular dominance. In the analysis of the scores men who had fired before at a rifle range were omitted from consideration. A preliminary study of the averages made by 2 companies disclosed that the purely dextral men made the best showing, and the purely sinistral the worst (table I). This poor performance of the left-handed was

TABLE I.—*Sample average scores of inexperienced recruits*

Classification	Number of men	Prone slow fire	Sitting slow fire	Prone timed fire
Right-handed:				
Right eye	100	38.7	37.2	35.3
Left eye	50	32.1	28.3	26.3
Left-handed:				
Right eye	25	31.2	28.6	29.3
Left eye	10	28.3	27.5	21.5

TABLE II.—*Influence of eye dominance on marksmanship in right-handed recruits*

Eye dominant	Number of men	Range of scores	Mode	Mean score	Score upper quartile	Median score	Score lower quartile	Skewness
RIGHT	720	0-50	40	30.7	39.5	33	24	-.75
LEFT	136	0-44	39	26.5	37.5	28	18.5	-.88

anticipated as the Springfield bolt-action rifle is designed for the right-handed, and only from the right shoulder can it be safely and efficiently used. Hence further study, applying more refined statistical methods, was restricted to the inexperienced right-handed marksmen, of whom there were 856. Of these 720 (84 percent) were right-eyed, and 136 (16 percent) were left-eyed. In each group a tally was made of the scores at timed firing, and the number of men per score from 0 to 50 charted. From these graphs the data submitted in table II are derived. The mean score (arithmetical average) was for the right-eyed 30.7 against 26.5 for the left-eyed. The median score (the value above or below which included half the group) likewise favored the right-eyed, 33 vs. 28; as also did the lower quartile score, 24 vs. 18.5. But the difference in the upper quartile score is significantly much less—39.5 against 37.5. The mode (score of greatest frequency) was 40 and 39, respectively. Negative skewness—the mean being less than the mode—characterized both curves, especially that for the left-eyed.

PREVIOUS STUDIES

A thorough investigation of the literature located but two papers dealing with marksmanship as affected by ocular dominance. In 1935 Banister (8) examined about 1,000 experienced infantrymen in the British Army of whom a large proportion had over 3 years' service. Their classification as marksman, first, second, and third class was accepted as a standard of shooting ability. Of the total, 69 percent of the right-eyed qualified as marksman first class against 54 percent of the left-eyed. In 1915 Doyne (9) submitted a brilliant discussion on the use of the eyes in shooting based on personal observation of marksmen, good and bad, right- and left-eyed. He concluded that ocular dominance does not affect marksmanship adversely when the rifleman is trained to shoot with both eyes open.

SHOOT WITH BOTH EYES OPEN

The small difference in shooting efficiency between the right-eyed and left-eyed in the upper quarter of each group suggests that ocular dominance may play a subordinate role in naturally good marksmen. The recruits are instructed to shoot with both eyes open but those who find this difficult or are inadequately impressed with the importance of binocular sighting often shut or cover the left eye. If a left-eyed man is tempted to sight with the dominant eye by leaning his head over the butt of the rifle, his front teeth may be knocked out, as Banister found had actually happened to one corporal.

In binocular sighting, the impressions from the two eyes are synthesized along a mental line of vision as is readily illustrated by a few simple experiments:

a. Hold a tube with the right hand and look through it with the right eye while the left palm is held alongside its distal end. A startling effect results, as the scenery is now seen through a hole in the hand.

b. Close the nondominant eye and with a finger before the dominant eye block out from view some object across the room. On opening the nondominant eye the object is clearly seen through the apparently transparent finger.

c. The last experiment is to be tried on the firing range. Place in front of the rifle sights a card obstructing the view between the sights and target. With both eyes open, you will see the target through an apparently transparent card, and if the aim is true, you should score a bull's-eye, even though the target is seen with one eye, and the sights with the other.

With both eyes open the marksman has a clearer view of the bull's-eye, estimates distance and direction better, shoots faster, and with less sense of strain. The recruit should concentrate primarily at what he is shooting; secondarily on the sights, as the sights need only be distinct enough to produce a definite impression. If the sights appear double (due to crossed diplopia), the right-hand image is to be ignored. The left-eyed marksman, who uses binocular fixation, shoots truly, but if he picks up the alinement with the left eye he misses constantly to the left. Muscle sense is developed along with sighting, so that in the perfected shooter bringing the gun to the correct alinement automatically gives the impulse to pull the trigger.

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NEWER CONCEPTS OF CIRRHOSIS OF THE LIVER

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INTRODUCTION

The history of cirrhosis of the liver is many years old. Ancient medical writers referred to this disease with disappointing and fatal

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[1] Work done while on duty at the Mayo Clinic, Rochester, Minn.

prognosis, and they apparently assumed that death was imminent within a few months after ascites appeared. The old literature on the subject deals with its morbid anatomy and possible etiology, but little was said about how patients with this disease were treated. Within recent years the advanced knowledge in the field of nutrition, plus a better understanding of the normal physiology of the liver, has aided in the formulation of newer concepts of the etiology and treatment of this disease. This report is only a brief summary of the current thoughts in this direction and outlines a program for treatment of cirrhosis now employed in some of the recognized clinics of the United States.

PATHOGENESIS

In the past cirrhosis of the liver has been attributed to a number of probable etiologic agents. The agents previously most commonly thought to produce parenchymal changes and hepatic injury, with only circumstantial evidence to support the view, were alcohol, bacterial or unknown toxins, syphilis, intestinal poisons, copper, and various chemicals too numerous to enumerate.

Mann (1) pointed out that the role of the liver as the commissariat of the body and as a regulator of the chemical composition of blood makes knowledge of the physiology of the liver a prerequisite to successful treatment. It is now known that hepatic function depends on several factors:

1. Activity of the polygonal parenchymatous cells and the relationship of these cells to body fluids.
2. The permeability of endothelial membranes and bile canaliculi.
3. The patency of the bile ducts.
4. The volume and composition of the body fluids that flow into the liver.

It is now recognized that the liver, among other important functions, acts as a chief storage depot for many vitamins and plays an important role in their utilization and synthesis. The role of the liver in the metabolism of blood coagulation factors, such as prothrombin and fibrinogen, is well known.

It has been established that patients who have hepatic disease frequently have decreased values of serum protein; this is especially true in cirrhosis of the liver. In 1931, Bollman and Mann (2) demonstrated that large amounts of vegetable protein could be fed to animals that had hepatic damage without harmful effect. The primary lesions in cirrhosis are fatty degeneration, necrosis and atrophy. These processes are followed by regeneration of hepatic cells and formation of new lobules in the liver. Bollman and Mann (3) demonstrated experimentally that a high hepatic content of glycogen is the primary factor in protection of the hepatic parenchyma and that a high hepatic content of fat permits degeneration of the paren-

chyma. Ravdin (4) pointed out that cases in which the content of glycogen and fat is high are as susceptible to hepatic disease as in cases in which the content of glycogen is low. These investigations disclosed that a high content of protein and carbohydrate in the hepatic cells offered the best protection to the hepatic parenchyma and against injury to the liver.

During the last few years, other investigators (5–12) demonstrated that in addition to the proper proportion of carbohydrates, fats, and proteins necessary for proper hepatic function, another factor is necessary, namely, the vitamin B complex. Experimentally, it was demonstrated that after a few weeks, fatty infiltration is followed by cirrhotic change. When brewers' yeast was added to the diet, the pathologic hepatic changes did not occur. It has been revealed that choline, betaine and methionine also have lipotrophic effects.

NEW CONCEPTS FOR ETIOLOGY AND BASIS FOR MODERN TREATMENT

The physiologic considerations give strong support to the hypothesis that cirrhosis of the liver is a deficiency disease and that nutritional errors lay the groundwork for the succeeding pathologic changes that follow. Certainly, many features of the disease are results of the inability of the liver to utilize or synthesize essential substances for normal growth of tissue. On this suggestion the present method of treatment of cirrhosis of the liver is based.

TREATMENT OF CIRRHOSIS

Treatment of cirrhosis of the liver at the Mayo Clinic has changed considerably in the past 3 years. Older application of treatment was devoted principally to elimination of ascites by mercurial diuretics, restriction of fluid and purgation. These have been largely abandoned and reliance has been placed chiefly on a diet high in carbohydrate and protein with large doses of vitamin supplements.

The general plan of treatment employed at the clinic since 1938 has been about as follows:

The patient is provided with a diet containing from 350 to 500 gm. of carbohydrate, 110 to 145 gm. of protein, chiefly of vegetable origin or derived from milk or egg white, and approximately 60 gm. of fat. Recently, this diet has been modified somewhat because of difficulties in its preparation, and approximately 50 percent of the protein allowed is now derived from meat.

In addition to this dietary program, patients also are given rather large doses of vitamin supplements. Vitamins A and D, in the form of concentrated fish liver oil, are given in doses of from 25,000 to 50,000 international units once or twice a day. Thiamine chloride is given by mouth in doses of 1 mg. ten times a day. Citrus fruit juices in doses of from 8 to 12 ounces (240 to 360 cc.) daily supply ascorbic acid. Brewers' yeast is given in doses of from 30 to 50 gm. a day, either in tablet form or in the powdered form mixed with tomato juice or eggnogs prepared with milk. Recently concentrates of liquid yeast have been used in varying doses. A few patients are given

nicotinic acid amide. Practically all patients are given liver extract, either as an aqueous solution by mouth in doses of 1 fluid ounce (30 cc.) three times a day, or in the form of crude aqueous extract of liver administered parenterally. This has been given intramuscularly in doses ranging from 3 to 5 cc. two or three times a week. While the patients are in the hospital, this material, together with solution of dextrose, is administered intravenously. Aged patients receive dextrose intravenously while under treatment in the hospital and in many instances, suitable amounts of nicotinic acid amide and thiamine chloride are given parenterally with the dextrose.

The results of treatment of a group of 50 patients according to this general plan were studied recently by Fleming and Snell (13). These patients were those who came to the clinic in the latter part of 1938, and during 1939 and 1940. On January 1, 1941, 30 of these 50 patients were dead and 20 were living. Fifty-five percent of the 20 patients who were living had improved markedly, while the remaining 45 percent revealed little evidence that the course of the disease had been altered. The average duration of life in the cases in which death occurred was disappointingly low, a state of affairs probably referable to the advanced stage of the hepatic lesion at the time the patients were first examined. It is significant that about three times as many patients, considered on a percentage basis, were free from ascites and enjoying a reasonably normal existence as in any other group of cases of cirrhosis in which the results of treatment have been reviewed at the clinic.

Recently, Patek and Post (14) reported a group of cases in which a similar type of treatment was given. At the end of the first year the survival rate was 67 percent in the treated group, as contrasted to 35 percent in the control group. At the end of the second year the improvement in the statistical figures was even more striking; 45 percent of the patients treated by this method survived, as compared to 21 percent of those who did not receive treatment of this type.

SUMMARY

Statistics from the clinic and those of Patek and Post, of New York, prove the value of the therapeutic program as outlined in the presentation. The results are most encouraging, and hope may even be entertained that this method of treatment furnishes some protective factor in hepatic disease.

The continuance of a primarily dietetic program of this type is by no means easy. The patients often require prolonged hospital care, careful nursing and meticulous attention to the details of treatment. Improvement is slow, and patience, optimism and persistence are obviously necessary for both patient and physician.

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THE RELATION OF BLOOD GROUPS TO DRUG REACTIONS
A PRELIMINARY REPORT

By Lieutenant Commander H. H. Carroll, Medical Corps, United States Navy

Since the discovery by Domagk in 1935 that prontosil had a definite bacteriostatic effect on Lancefield's group A strain of hemolytic streptococci, there has been widespread use of it and various other sulfonamide compounds. These have been used in the treatment of nearly every infective process that affects the human organism, running the gamut from streptococcic meningitis to the common cold.

While the therapeutic results from these drugs have been consistently good and at times spectacular, many and varied toxic reactions from their use have been reported. It was to be expected that drugs which are so potent against many of man's most malignant bacterial enemies, would not be tolerated in large doses by all the patients who received them. Reports of their toxicity accumulated rapidly. These toxic reactions range from comparatively mild ones

such as malaise, anorexia, nausea, vertigo, and tinnitus to hemolytic anemia and agranulocytosis. Included in the toxic manifestations noted are cyanosis, fever, cramps, diarrhea, various forms of dermatitis, anuria, renal calculi, amyotrophic lateral sclerosis, encephalitis, peripheral neuritis, psychoses, toxic hepatitis, purpura hemorrhagica, and exfoliative dermatitis.

The exact cause of these toxic reactions is still a matter of speculation. Wood (1), who reported one of the first series of toxic reactions in 1938, found that there apparently was no connection between the dosage or the blood concentration of the drug and the development of toxic reactions. He concluded that:

Acute anemia associated with sulfanilamide therapy must be classed as a drug idiosyncrasy, especially in view of the fact that the majority of patients who have once suffered an attack appear to be susceptible to recurrent attacks.

Watkins (2) made an observation in 1939 which prompted the present investigation. At that time he had the impression that a considerable majority of patients suffering from various blood dyscrasias belonged to group A. His recent survey (3) of cases at the Mayo Clinic has evidently shown that this impression was not substantiated by their statistics, as he concludes in the above-mentioned article:

It seems fairly obvious that in any series large enough to justify the formation of conclusions there is no apparent relationship between an individual blood group and any specific hematologic disease.

In relation to the present discussion it is of interest to note that neither hemolytic anemia nor agranulocytosis are included in his recent statistical study. Watkins also reviewed the various attempts that have been made to correlate the blood groups and various pathological conditions, none of which have proven anything definitely.

In the fall of 1939, while serving on the U. S. S. *Relief*, a severe case of agranulocytosis resulting from sulfanilamide therapy in a patient belonging to group A came to my attention. I investigated the blood group of all the cases which followed during my tour of duty on the U. S. S. *Relief*. There were six cases in all, none serious, but they all belonged to group A.

During the summer of 1941, letters of inquiry were sent to practically all of the American and Canadian authors of articles reporting severe reactions to the sulfonamide drugs, considering especially those who had reported cases of agranulocytosis and hemolytic anemia. Returns have not been at all complete, but many authors have been kind enough to furnish the data required, which furnishes the basis for this preliminary report.

The exact percentage of the population that fall into the various blood groups evidently varies according to race and nationality, but the original figures as given by Moss agree rather well with the more recent study by Watkins on a control series of 1,000 cases, these being the first 1,000 persons whose blood was grouped at the Mayo Clinic since January 1, 1941, irrespective of any pathologic condition. These percentages follow:

TABLE 1

	AB	A	B	O
	Percent	*Percent*	*Percent*	*Percent*
Moss	10	40	7	43
Watkins (Mayo Clinic)	4	43	8	45

So far, returns have been received on 50 cases that were serious enough to be reported in the literature during the past 3 years. They are arranged according to blood groups below:

TABLE 2

	AB	A	B	O
Number	11	24	4	11
Percentage	22	48	8	22

Examining this, we see that group O, the most common group, and group AB, the least common group (Mayo) have the same percentage of severe toxic reactions; and group O has less than half as many as group A, despite the fact that O is the most common blood group.

The fatal cases are even more interesting and are arranged according to blood group in table 3 below:

TABLE 3

	AB	A	B	O
Number	1	10	0	2
Percentage	7.7	77	0	15.4

In this connection it is of interest to note that the two fatal cases in group O were patients who had combinations of severe infections with surgical procedures, the combination of which was enough to account for their deaths. The drug reactions may have contributed to their deaths, but the fatalities cannot be regarded as due principally to the drug. This being the case, there has been no instance in the cases considered in this report where a patient belonging to group O has died as a result of a drug reaction from the sulfonamide drugs.

SUMMARY

While the number of cases presented in this discussion is far too small to permit any accurate conclusions, still there does seem to be a significant difference between the number of cases in groups O and A, the two most common blood groups. This is particularly true among the fatal cases. The comparative freedom of group O from reactions indicates that the susceptibility to reactions may be linked in some way with the agglutinins and agglutininogens which are present in the blood of all patients except those in group O.

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THE CHEMOTHERAPY OF BACILLARY DYSENTERY [1]
FURTHER OBSERVATIONS ON SULFAGUANIDINE

By Commander George M. Lyon, Medical Corps, United States Naval Reserve

The use of sulfaguanidine in the treatment of acute bacillary dysentery has been described in a report (1) based on the study of a small series of patients having the disease in a severe or moderately severe form. In this study alternate patients were treated with the chemical while others, as controls, were not. Since that time sulfaguanidine, the guanidine analogue of sulfapyridine, has had extensive practical application in the management of patients with "bloody flux" in the offices, homes, and hospitals of an area wherein bacillary dysentery is an important disease. An unusual opportunity for this study was presented by the occurrence, during this time, of what was probably, in the counties concerned, the highest incidence of the disease since 1926. More than 300 patients with "bloody flux" were treated with sulfaguanidine. Their records permit an appraisal of the effectiveness, and the suitability, of this chemical agent for general practice in the treatment of acute bacillary dysentery, not only in the hospital, but of perhaps even more practical importance, in the offices and homes as well. A more detailed analysis of these records has already been presented (2) (3) (4).

With few exceptions the method of administration employed was that originally recommended by Marshall (5) and employed in the previous clinical study (1). The initial dose was 0.1 gram per

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[1] Received for publication October 30, 1941.

kilogram of body weight, while the maintenance dose was 0.05 gram per kilogram of body weight administered orally every 4 hours until the stools were less than 5 in 24 hours, and then 0.05 grams per kilogram of body weight every 8 hours for 48 to 72 hours. That an adequate urinary output should be maintained, had been stressed repeatedly and in general was well observed. Particular attention was paid to the detection of any untoward effects which might result from the administration of the relatively new chemical.

From this experience certain impressions have been gained in addition to which there are some more definite conclusions which may be drawn, and it is, therefore, possible now to present further recommendations in regard to the clinical use of the drug.

Sulfaguanidine proved to be an effective therapeutic agent in the treatment of acute bacillary dysentery. When used in the manner described, and when treatment was begun during the first 5 days of illness, recovery usually occurred in 2 to 5 days. In the majority of instances, 5 days of chemotherapy was all that was required. When so used sulfaguanidine was entirely free from toxic effects. This freedom of dangers from toxic effects is in striking contrast to that of the other sulfonamide compounds, one of which, sulfathiazole, is described as being quite as effective as sulfaguanidine in the treatment of acute bacillary dysentery and which indeed may be more effective than sulfaguanidine in the treatment of the diarrheas resulting from parenteral infections (6) (7).

As previously stated, when chemotherapy was begun within 5 days of the onset of fever or diarrhea, and when employed in the manner described, recovery almost invariably followed in 2 to 5 days. When not employed until later in the disease, results were frequently amazingly good, but failures were encountered somewhat more frequently. When treatment with the drug was begun after the fifth day and before the eleventh day, results, as a rule, were better than when begun after the eleventh day, but not as good as during the first 5 days. The importance of early treatment cannot be overemphasized.

When there was blood and pus in the stools and when there was fever present, even though the treatments were not begun early in the disease, results were nearly always as satisfactory as in the patients treated earlier. When, however, the dysentery bacilli had disappeared, and when there was no blood or pus in the stools; when the stage of bacterial activity was passed and the stool was of the green watery type (so characteristic of the frequently encountered "post-infection" intestinal indigestion), sulfaguanidine had the least beneficial effects. This is to be expected, however, in view of the underlying pathology.

It is an outstanding characteristic of acute bacillary dysentery, although one frequently overlooked, that with remarkable frequency the stage of active bacterial infection is followed by an impaired ability on the part of the intestinal tract to digest and to assimilate food. It is generally accepted that this occurs as a result of the damage produced within the gastro-intestinal tract by the dysentery bacilli, or their toxins. This form of "post infection" intestinal indigestion was formerly very common among infants and young children, and is not infrequent today in those dysentery patients not receiving chemotherapy. Although less common in adults, this sequela is not at all an infrequent one. Since this condition results from damage done to the intestinal tract by the bacilli themselves, or by toxins produced by them, and since the bacilli by this time have usually left the intestinal tract, or have been supplanted by secondary invaders, one cannot expect sulfaguanidine to be such an effective agent in clearing up this diarrheal state. In actual practice it did not do so.

Sulfathiazole is said to be effective in those cases where the continued diarrhea is the result of secondary invaders, with or without deep ulceration. On theoretical grounds there is indeed much to recommend it, or sulfadiazine, in such instances, and either may be more effective than sulfaguanidine. Fortunately, such conditions are not commonly encountered and practically never occur if chemotherapy is instituted early in the infection. Occasional cases of diarrhea were encountered which appeared to be simple watery diarrhea, without significant bacterial infection, without blood and pus in the stools, and which, despite adequate chemotherapy, did not yield to either sulfaguanidine or sulfathiazole. In such cases the diarrhea may possibly have been due to:

1. A previously undetected acute bacillary dysentery with the subsequent development of the "post infection" intestinal indigestion already described.

2. A parenteral infection not discovered.

3. A diarrhea due to a local or systemic virus infection.

In general, the best results with sulfaguanidine were obtained in those patients treated earliest after onset, who were most ill, and who had blood and pus in their diarrheal stools at the time chemotherapy was begun. It was least effective in those in whom treatment was not started until after the acute bacterial invasion was over, when the stools were simply green, watery, and without blood, pus, or dysentery bacilli.

Sulfaguanidine appears to be equally effective against all of the various strains of dysentery bacilli. Paradoxical as it may seem, it has appeared to have its most striking effect in the treatment of the toxic Flexner and Shiga strains. Two instances of Shiga were

added and the results were the same as with Flexner. This has since been amply confirmed by Hardy and others. There is some limited evidence to suggest it was somewhat less effective against the clinically less toxic Sonne strain, one which so frequently gives rise to mild afebrile diarrhea without blood in the stools and often with little pus.

Most of the toxic effects which have been observed in the use of the other sulfonamides have also occurred following the use of sulfaguanidine. Such have, however, occurred almost invariably when the drug had been given in doses larger than recommended by Marshall and doses that were larger than those employed in the present study, and when, likewise, due regard was *not* paid to the importance of the frequency and the character of the stools, and to the relationship this has to the concentration of the drug in the intestinal tract when the stools are infrequent. Such toxic effects can be avoided almost entirely by employing the drug as recommended originally by Marshall, provided there is meanwhile an adequate urinary output, which definitely enhances the likelihood of there being no toxic effects. An adequate urinary output is always a desideratum in the treatment of acute bacillary dysentery. The fact that treatment is usually terminated in 5 to 7 days is an added safeguard against toxic effects. Toxic effects may have been encountered somewhat more frequently in adults than in infants or young children where they were almost entirely missing.

Although sulfaguanidine was least effective after the first 5 to 10 days of illness, and after the blood and pus in the stools had given way to the plain watery stool which contained no dysentery bacilli, there is sufficient evidence at hand to indicate the desirability for the use of sulfaguanidine in all suspected cases of bacillary dysentery, "flux," or "infectious diarrhea" with fever. It should be given for 5 to 7 days and thereafter if recovery has not occurred it may be best to give sulfathiazole, or still better, perhaps sulfadiazine, for another 5 to 7 days. In the meantime, strict regard must be paid to the urinary output, for with all of the sulfonamide compounds there is a strict relationship between adequate urinary output and freedom from toxicity. This is particularly to be remembered in the use of sulfathiazole and sulfadiazine.

Where there are obvious or suspected infections outside the gastrointestinal tract, it may be desirable, at the onset, to use sulfathiazole, or sulfadiazine, in the place of sulfaguanidine. While in such instances this practice may perhaps be more effective, in the experience described, it was never necessary to resort to it in the early stages of the acute infection. Also it presented no strikingly favorable results in the treatment of those cases with such complications observed 10 or more days after the onset of diarrhea.

Although potentially carrying a greater risk of toxicity, both sulfathiazole and sulfadiazine have been shown to be effective in the acute stages of bacillary dysentery. Because of their greater tendency to produce toxic effects, and because of the greater care with which they must be given, it would seem that they should be the drugs of secondary choice in the treatment of acute bacillary dysentery in the early stages. In the later stages, or in the state of "post-infection" intestinal indigestion, their use may be more strongly indicated. For use in the home, office, or dispensary they are definitely not so safe as sulfaguanidine, and should not be employed as sulfaguanidine may be. One of the most satisfactory features of sulfaguanidine is the large margin of safety permitted in this respect without sacrificing therapeutic efficacy. It is necessary, frequently, to treat cases of acute bacillary dysentery without the benefit of hospitalization. For them sulfaguanidine is distinctly the drug of choice. Experience has proven that good results have followed this practice.

Excepting new-born, no deaths occurred among the patients treated with sulfaguanidine provided treatment was begun during the first 5 days of illness (diarrhea and fever) and such cases did not have other important infection outside the intestinal tract. Parenteral infections, whether due to a virus of the influenza type, or to pyogenic bacteria, were observed to exert a detrimental influence on the clinical progress of the patient with bacillary dysentery just as they have on other diarrheal states. It is not logical to expect that such parenteral infections would yield to sulfaguanidine therapy. On the other hand, it was observed, more frequently than not, that under the influence of the drug, the stools became normal promptly and the intestinal tract appeared better able to carry out its work.

In the latter stages of acute bacillary dysentery or its sequela, it may be impossible to determine which of the difficulties encountered are due to a continuation of the primary bacterial invasion, to secondary invaders of the intestinal tract, to parenteral infection, or to damages within the intestinal tract due to the primary bacterial invasion. This complicates the problem of appraising the effectiveness of any chemotherapeutic agent used in acute bacillary dysentery or other diarrheal states.

No persistent states of "post-infection" intestinal indigestion developed in any of the patients in whom chemotherapy was started within 5 days of the onset of fever or diarrhea.

Those cases receiving the chemical early, showed surprisingly little disturbance of digestion either during the period of active therapy or following recovery. In spite of this, however, it has seemed advisable to employ a bland diet, moderately restricted in amount, during the period of active treatment. There is some reason, based

upon careful observation, to believe that those patients who were on a diet which was high in protein (casein), and which was moderately restricted in amount, presented the best and most prompt recoveries. Cultured lactic acid milk, cottage cheese, Philadelphia cream cheese, and custard, when given in moderate amounts, seemed to be the diet of choice. Vitamins, in powder form, were added to the cultured lactic acid milk and may, or may not, have influenced the recoveries.

Sulfaguanidine was most effective during the time when the dysentery bacilli were more active. It was least effective when the activity of these bacteria was absent and when their residua remained within the intestinal tract in the form of abnormal physiologic states. While the chemical effectively controlled the activity of the bacteria, it did not, by itself, correct damages already produced by the bacteria, or their toxins, once such damage was already established. By controlling the bacterial infection, sulfaguanidine may have aided such supportive measures as adequate fluid intake, intravenous glucose, calcium gluconate, transfusions of serum or whole blood, et cetera, so that they might, more effectively, correct attendant chemical pathology. It should be emphasized that sulfaguanidine did not and will not overcome acidosis, dehydration, fiuid imbalance, or electrolyte disturbance.

When altered physiologic states, or those characterized by unusual chemical pathology, were already present before the institution of chemotherapy, it was necessary to employ measures directed toward these specific conditions. In the more protracted forms, and in the absence of such special measures, chemotherapy would undoubtedly have been much less effective.

Sulfaguanidine was not as effective in recurrent attacks of bacillary dysentery, nor in the more chronic forms, as it was when used within 5 days after the onset of the original attack. If, on the other hand, the stools contained blood or pus, and there were dysentery bacilli in the stools as shown by culture, the results were generally very good. It was difficult to predict what the result would be. At times, so striking and so prompt were the beneficial effects of the drug, in these forms of bacillary dysentery, that one cannot escape the conviction that sulfaguanidine should be administered in all forms of bacillary dysentery for at least 5 to 7 days in the manner recommended. If at the end of that time recovery is not apparent, then sulfathiazole or sulfadiazine should be given for 5 to 7 days. Some of the most amazing results so far encountered in the use of sulfaguanidine occurred in stubborn, serious cases of chronic bacillary dysentery.

Relapses, whether early or delayed, were extremely rare after the use of sulfaguanidine in the treatment of acute bacillary dysentery.

Certainly this was in striking contrast to the frequency with which such conditions occurred in those who did not receive chemotherapy.

There was no reason to believe, either from the bacteriologic or from the epidemiologic standpoint, that the use of sulfaguanidine tended to "mask" infections of dysentery bacilli, or to complicate the community health situation by increasing the "carrier" rate.

In homes where outbreaks, resembling the institution type of outbreak of bacillary dysentery occurred, it was possible, with sulfaguanidine, to promptly and effectively control, not only the individual cases, but the spread of the outbreak as well. The chemical has great value as a control agent in outbreaks occurring among those whose living conditions are crowded, which, so frequently, are encountered in mining areas, in the poorer districts, and even in military camps and establishments. It is possible, in an institution, to check such an outbreak within a few days by giving everyone in the institution the chemical for a period of 5 to 7 days. It must be remembered that, in so doing, the maintenance dose should be employed, and given only every 8 hours, if the stools are less than 5 a day as they are apt to be in those not already stricken with the malady.

Sulfaguanidine is of definite value in reducing the number of days of illness due to bacillary dysentery. This gives it unusual importance in industrial and military medicine. Its wider use will result in a continuously lower dysentery mortality rate.

Early recognition and early treatment are just as important in the treatment of bacillary dysentery as the antibacterial activity of the chemical itself. Best results were definitely attained when chemotherapy was applied early in the disease.

Sulfaguanidine is quite as effective in the treatment of acute bacillary dysentery in adults as it is in infants and young children.

Chemotherapy has completely revolutionized the treatment of bacillary dysentery. Sulfaguanidine is quite as effective in the treatment of acute bacillary dysentery as sulfanilamide is in the treatment of some streptococcal infections or as the other sulfonamide compounds are in the pneumococcal infections. Besides its therapeutic effectiveness, the chemical is easy to give and has such a wide margin of safety that it is the ideal agent to use in the treatment of bacillary dysentery.

Note.—Since submitting this report, it has been possible to observe the treatment of 14 patients with severe or moderately severe bacillary dysentery, who were treated with succinyl sulfathiazole. In severity and in clinical characteristics, these were in all respects similar to those previously described in a controlled study (1). The initial dose was twice the maintenance dose. This in turn was 0.04 gram per kilogram of body weight every 4 hours if six doses were given daily, or 0.05 gram per kilogram if five doses were given daily at

approximately 4-hour intervals. After the diarrhea had been "checked" for 72 hours the drug was discontinued. In this admittedly small series of cases, succinyl sulfathiazole appeared to have all the virtues of sulfaguanidine as to therapeutic efficacy and as to freedom from untoward effects. It was exceedingly well tolerated.—[G. M. L.]

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REPORTS OF MEDICAL SURVEY

A REVIEW OF LAW PERTAINING THERETO [1]

By Lieutenant Commander Robert A. Bell, Medical Corps, United States Navy

One of the many routine official duties of a naval medical officer, and not one of the least important, is to serve as a member of boards of medical survey. The importance of this particular duty should be emphasized. The rights to pensions and compensation (which are now costing the United States Government approximately $433,-000,000 annually) and other incidental expenses including the cost of hospitalization and domiciliary care (which run in excess of $60,000,000 annually) are based to a considerable extent on the facts presented and opinions expressed by boards of medical survey. Obviously these will increase from now on to an indefinite future.

Every time a survey board recommends that an individual be discharged from the service by reason of physical disability *incurred in the line of duty*, the net effect (if the discharge is effected) is equivalent to writing a blank check against the United States Treasury for an undeterminable amount. This may eventually run as high as $50,000 or more, for, in addition to the outlay for pensions and compensation, the Government furnishes free medical attention and hospitalization

to ex-service personnel who have been discharged by reason of service-connected disabilities. Thus in addition to the generally recognized purposes of boards of medical survey, which are enumerated in the following paragraph, the net effect of the boards' action to the Government in a financial way should be considered.

The personnel in the naval service are brought before boards of medical survey chiefly to obtain an opinion as to the nature of a case, establish the origin of a disability, determine fitness for duty, continue treatment beyond 3-month intervals, effect transfer of patients from one activity to another, and to dispose of personnel with physical or mental disabilities or personality defects.

The report of a board of medical survey is ultimately filed in the Bureau of Medicine and Surgery. It becomes a permanent record for later use in connection with claims for benefits provided by law. The majority of these benefits are contingent upon the origin of the disability and whether service aggravation has occurred. In cases where discharge from the service is involved, it is particularly important that the origin of the disability be accurately determined. Experience has shown that a goodly number of these reports must be returned for clarification in order that the rights of both the individual and of the Government may be protected. This is particularly true in the case of individuals who are recommended for discharge during their first enlistment.

The procedure to be followed in submitting reports of boards of medical survey is set forth in existing regulations.[1] The instructions, especially those in the Manual of the Medical Department, are detailed, explicit and clear. There is, however, no readily available compilation of the laws, regulations, court-martial decisions and other data such as precedent and policy which govern expressions of opinion as to misconduct, service aggravation, and line-of-duty status of disabilities. Such a presentation should prove useful as a guide and to indicate the importance of the collection and presentation of facts to justify the findings of the board.

In general the body of a survey report should contain all the pertinent ascertainable facts relating to the disability in question. From this presentation, recorded in chronological sequence, the board then draws its conclusions, records its opinions and makes a logical and reasonable recommendation. The facts presented should show the reason for admission to the sick list; justify the diagnosis and any change thereof; justify the board's findings relative to misconduct, origin of disability, service aggravation, present condition of

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[1] U. S. Navy Regulations—Pars. 1141 (1), 1197, 1198, 1199; Manual of the Medical Department—Pars. 1420, 2122, 2151, 2152, 2160, 3423; Bureau of Navigation Manual—Par. D-9116; Court Martial Orders.

patent and probable duration of the disability; and justify the recommendation. It is also desirable that information be included concerning provisions made for the safeguarding of insane patients on discharge,[2] for the safeguarding of public interests in the cases of individuals to be discharged with infectious diseases,[3] for the care of patients who require further treatment after discharge, and for the care after discharge of those who will be eligible for and in need of Government benefits.[4]

The misconduct status in a given case must be determined and stated by the medical officer[5] upon admission to the sick list, for, in the case of disease as distinguished from injury[6] it governs pay status. In questionable, doubtful, or conflicting opinions, the case record is referred to the Judge Advocate General's Office, Navy Department, together with the commanding officer's opinion, via the Bureau of Medicine and Surgery, for decision.[7] As a general rule mere negligence or carelessness is not misconduct. Misconduct is a violation of law or regulation; in short, an act for which the person could have been court martialed.[8] An act that is wilful, or shows such gross negligence as to imply a reckless and wanton disregard for the safety of life or property is always misconduct.[9] The law[10] governing misconduct states,

A disability will be held to have resulted from misconduct when it is due to venereal disease, unless it is affirmatively shown that the disease was, in fact, innocently acquired; or when caused by an act of commission or omission, wrong in itself; or by an act contrary to the principles of good morals; or as a result of gross negligence, gross carelessness, alcoholism, drug addiction, or self-infliction of wounds.

In addition to the foregoing, general order No. 20 and previous court-martial decisions should be consulted.

Before an act of misconduct can be held to be the proximate cause of death, there must be evidence to complete the chain of causation between the two. Theories, however probable they may be, are not enough. Evidence must be adduced to prove that the deceased committed an act of misconduct and that this act resulted in his death (C. M. O. 4-38, p. 13).

An enlisted man was injured when struck by an automobile while on authorized liberty; he was somewhat under the influence of intoxicating liquor at the time, but apparently not to such an extent as to deprive him of the

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[2] Bureau of Medicine and Surgery Manual, par. 2160.

[3] Bureau of Medicine and Surgery Manual, par. 3423 (m) (7) (4), 2122, 2160; Bureau of Medicine and Surgery Letter No. P3–1/P19–1 (054) dated Aug. 28, 1939; Bureau of Medicine and Surgery Letter No. P3–3/P3–1 (054) dated Apr. 14, 1941.

[4] Bureau of Medicine and Surgery Manual, pars. 2122, 2160.

[5] U. S. Naval Regulations par. 1196 (1) and Manual of Medical Department chapter 16.

[6] U. S. Naval Regulations par. 1196 (2).

[7] U. S. Naval Regulations par. 1196 (5) and Manual of Medical Department par. 2289.

[8] Naval Courts and Boards, par. 710 L. R. N. A., 1929, p. 578–581.

[9] Naval Digest, 1916, pp. 341 and 344.

[10] Public No. 648—75th Cong., chap. 468, 3d sess. (H. R. 7880), which amended par. IX of Executive Order No. 6098, dated Mar. 31, 1933.

use of his faculties; there was no evidence that his intoxication was the proxi-
mate cause of his being struck; the Board of Investigation was of the opinion
that his injuries were not due solely to his own misconduct; the convening
and reviewing authorities were of the opinion that intoxication was the major
factor in making the accident possible. *Held* that he should be given the
benefit of the doubt and that his injuries were not due to his own misconduct
(C. M. O. 2–37, p. 3).

Disability resulting from injury received while under the influence of intoxi-
cating liquor, and which was the result of the individual's inability to properly
care for himself due to his intoxicated condition, has been held to be due to his
own misconduct (L. R. N. A. 1929, p. 486).

It is particularly important that records contain the information
required to determine whether disabilities are or are not service con-
nected for pensions, compensations, medical attention, hospitaliza-
tion, institutional care, and other rights and privileges prescribed by
law for service and ex-service personnel, are in many instances con-
tingent upon death or disability incurred in the line of duty.

For the purposes of naval jurisdiction the law governing line of
duty is set forth in decisions of the Navy Department, there being
no general rule, each case being decided on its own merits. These
decisions are published in court-martial orders and insofar as the
naval service is concerned, are binding on courts of inquiry and
boards.[11] This would appear to apply to statutory boards and
would not include boards of medical survey, which are merely execu-
tive instrumentalities used to obtain expert opinion as to the physical
capacity of an individual (L. R. N. A. 1929, p. 119).

It is the policy of the Navy Department to reserve decisions as to
line of duty until matters arise in the administration of the Navy
Department requiring such a determination or is required for the
purpose of determining whether a former member of the Navy or
Marine Corps is entitled to hospitalization. In cases of claims for
pension the Navy Department does not render decisions as to line of
duty for the determination in such cases is a matter solely under the
jurisdiction of the Veterans' Administration (C. M. O. 12–36(8)).

Thus we see the final determination of line of duty, insofar as pen-
sions are concerned, comes under jurisdiction of the Veterans' Ad-
ministration. Certain other benefits, as for instance hospitalization,
are determined by the line of duty status shown in the records on
file in the Navy Department. These records are reviewed at some
future date, when necessity arises, and therefore it is important for
medical histories to be accurate and complete.

Those medical officers who have personal cognizance of patients
who are surveyed with the recommendation that they be discharged
from the service are required to express an opinion as to line of duty

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[11] Naval Courts and Boards, chap. IX, footnote (1), L. R. N. A. 1929, p. 120.

origin in order that it may be used as a future guide [12]. Such opinion, supported by evidence of record, is of great importance in aiding the Veterans Administration in decisions with reference to benefits within the cognizance of that Administration (C. M. O. 10–37, p. 5; C. M. O. 10–31, p. 21; and 12–36, p. 8). It also aids the Bureau of Medicine and Surgery in rendering opinions when so requested by other departments.

To constitute line of duty the person must be in active service, but it is not material whether he is on active duty, on furlough, leave of absence, or under arrest. It is however, material whether the injury was due to his own willful misconduct. ("Willful" in this connection being distinguished from mere acts of negligence or unintentional or ignorant infractions of duty), or was due to something which he was doing in pursuance of a private avocation or business. It is not line of duty if the injury grows out of relations not connected with the service or is not the logical incident or probable effect of duty in the service (L. R. N. A. 1929, p. 120). It is worth emphasizing that portion of the foregoing which states in part, "It is not line of duty if—it is not the logical incident or probable effect of duty in the service."

It should be remembered that survey boards are presenting evidence not alone for the Navy Department but for the future guidance of the Veterans' Administration. The same considerations do not necessarily govern the two agencies insofar as decisions regarding the origin of a disability are concerned. The Veterans' Administration holds [13], in the case of applicants not in receipt of pensions for service-connected disability, that the official records of the Army or Navy, respectively, relative to findings of line of duty for its purposes, will be accepted in determining eligibility for hospital treatment under the provisions of this reference; except that in a case where the Army or Navy finds the disability was not incurred in the line of duty and the applicant presents controverting evidence— the Veterans' Administration will be free to make its own interpretation of line of duty incurrence.

Just what constitutes line of duty for pensions, compensation, and other benefits allowed by the Veterans' Administration was incorporated in a bill passed by the 75th Congress.[14] The provisions of this bill may be used as a guide by boards of medical survey in determining the line of duty status of cases recommended to be discharged from the service by reason of physical disability. A portion of the text of this bill follows:

[12] Bureau of Medicine and Surgery Manual, par. 1420 (b), 3428 (m) (3) (4) and L. R. N. A. 1929, p. 120.

[13] Veterans' Administration Regulations and Procedure, par. 6047 (B) (2).

[14] Public No. 648, 75th Cong., chap. 468, 3d sess. (H. R. 7880). An act to amend the Veterans' Regulation No. 10 (par. VIII).

Par. VIII. An injury or disease will be deemed to have been incurred "in line of duty" when the person on whose account benefits are claimed was, at the time the injury was suffered or disease contracted, in the active service, in the military or naval forces, whether on active duty or on authorized leave, unless it appears that the injury or disease has been caused by misconduct on his part: *Provided, however,* That the requirements will not be met if it appears that at the time the injury was suffered or disease contracted, the person on whose account benefits are claimed (1) was avoiding duty by deserting the service or by absenting himself without leave; (2) was confined under sentence of court martial or civil court or was resisting lawful arrest; (3) was relieved from all active performance of duty by command of his superior officer as a result of the intemperate use of drugs or alcoholic liquor or because of injury or disease contracted or suffered as a result of his own misconduct; (4) was acting in disobedience of the lawful orders of his superior officer or in violation of the rules and regulations of his organization; or (5) whether at his post or lawfully absent, if the injury or disease was, in fact, caused by something not involving misconduct but done in pursuing some private business or avocation.

Where the injury or disease occurs while on leave, the burden of proof (should any question arise) shall be on the claimant to show that it was incurred in the line of duty, but where the injury or disease occurs while at camp or post of duty, the burden shall be upon the Government to show that the disability was not in line of duty.

The Judge Advocate General has repeatedly held that when a member of the naval service is injured while on authorized leave or liberty, such injury must be considered in the line of duty unless caused by his own willful misconduct or some act or course of conduct disconnected with his military duties (C. M. O. 5-21, p. 17, 22; 6-22, p. 16, 18; 9-25, p. 24; 6-25, p. 7; 2-25, p. 15).

It is the view of the Navy Department that leave and liberty are given primarily for the purpose of recreation and relaxation. Any member of the naval service who meets his death while engaged in usual forms of recreation as in the case of accidental drowning while in swimming is considered to have died in the line of duty, provided death did not result from his own misconduct (C. M. O. 10-37, p. 5; C. M. O. 11-35, p. 10; C. M. O. 5-31, p. 25; C. M. O. 9-36, p. 19).

The foregoing is not always applicable in cases of injuries incurred in a leave status however:

An enlisted man was accidentally shot in the right forearm while hunting. Since he was on an extended period of leave from the naval service and the conditions existing at that time had no connection with his naval service, held that the disability resulting from this accident was not service connected (C. M. O. 3-37, p. 13).

Injury caused by an unprovoked battery is incurred in line of duty unless it grew out of domestic or other relations entirely separate and distinct from his relations with the Government (C. M. O. 1-39, p. 70).

An enlisted man, while resisting efforts of a shore patrol to effect his arrest as the result of a disturbance, sustained injuries to his

head. Subsequently he was convicted by summary court martial of resisting arrest. Held that the disability was due to his own misconduct (C. M. O. 11-36, p. 4).

A man was admitted to the sick list with diagnosis "Submersion, nonfatal" due to own misconduct. Evidence adduced before a board of investigation appeared to establish the fact that while voluntarily engaging in a fight with another enlisted man, the patient went overboard. The Navy Department held that the voluntary engagement in a fight constituted an act of misconduct and that the resulting disability, "Submersion, nonfatal," should be held to be the result of the man's own misconduct (C. M. O. 2-40, p. 193).

An enlisted man *on authorized liberty* sustained an injury (fractured skull), which resulted in his discharge from the naval service; the injury was received in an altercation with a civilian whom he found at his home with his wife when he returned unexpectedly at an early hour in the morning; there was no evidence as to who was the aggressor in the altercation or other available information concerning the surrounding circumstances, nor did it appear that it was due to the enlisted man's misconduct. The disability sustained as a result of this altercation obviously resulted from relations unconnected with the service, and accordingly, under the rules applicable to line of duty in the naval service, as set out in Naval Courts and Boards, it would be considered by the Navy Department to be incurred "not in line of duty." However, the Veterans' Regulations do not require that a disability must be held to be incurred "not in line of duty" for the reason that it occurs during a short period of absence or as a result of matters unconnected with the service, except where it occurs in connection with some business or private avocation. Under these circumstances, held that no determination of line of duty in this case will be made by the Navy Department in connection with hospitalization of the man in question under the Veterans' Administration, which is governed by Veterans' Regulations (C. M. O. 3-37, pp. 11-12). (Compare C. M. O. 12-36, pp. 8-9.)

In a decision interpreting the meaning of the term "avocation," the case of an individual who was injured by the explosion of a shell, which was introduced into the barracks by the injured party, is of interest:

While generally speaking, "avocation" means that which calls one away from one's regular employment or vocation, the thing which calls one away must be in the nature of a "subordinate occupation" (Webster's Dictionary). This same idea is conveyed in section 1022, Naval Courts and Boards, 1923, where the "private avocation" is made synonymous with or similar to "business" (C. M. O. 10-31, p. 20).

As a guide one might consider a "private avocation" as a subordinate occupation engaged in for personal aggrandizement. This term as used is *not* synonymous with a hobby, or a pursuit engaged in for recreational purposes. The use of the term "avocation" is apparently in accordance with the change in its meaning from "diversions" to "necessary employments" whereby it becomes synonymous with vocation.

From a review of the foregoing it would appear that decisions as to the origin of disabilities should be a relatively uninvolved question. This does not necessarily follow. It is in the field where medical opinion would appear to conflict with legal presumption that uncertainty exists. This arises chiefly among cases with relatively short periods of service who present disabilities which, in medical judgment, must have existed prior to enlistment. Some of the governing legal considerations follow:

When an officer or enlisted man or other member of the naval service has passed the required physical examinations for admission therein, he must be accepted as being in sound mental and physical condition at that time, except in those cases where positive facts are presented showing that the disability complained of existed prior to his entrance into the naval service (citing 32 Op. Atty. Gen. 12, 193).

Under recent decisions, the presumption of soundness at the time of entry into the service cannot be rebutted, except by actual facts pointing unmistakably to the conclusion that the disability complained of actually did exist prior to admission into the naval service. In all cases where there is no affirmative evidence to the effect the act complained of did not originate in the line of duty, the presumption exists that the disability did arise in line of duty (L. R. N. A., 1929, p. 121).

When an enlisted man is discharged from the service for physical disability, in accordance with the recommendation of a board of medical survey, and no physical defects were recorded in his medical record at the time of enlistment, such disability is regarded by the Navy Department as "service connected," in the absence of evidence that it existed prior to his enlistment (C. M. O. 5-37 (15).

The only facts which may be accepted as showing that the disability existed prior to enlistment are such as the records of creditable institutions, sanatoriums, and hospitals; or the statement of a reputable physician attending the individual prior to enlistment, that said individual had the disability complained of at the time he was in attendance upon him; or statements, of individuals qualified by experience and education to recognize the disability complained of, to the effect that the individual had said disability prior to his enlistment (C. M. O. 5-21, p. 21).

In view of the foregoing and in order that the rights of the government may be adequately safeguarded it is necessary that survey boards make every attempt to contact qualified sources of information whenever there exists a possibility that the disability in question may have existed prior to entry into the service. This is especially true in the case of individuals with short periods of service who present conditions which, in the light of the best of medical opinion, must have existed for a long time.

Any presumption as to predisposition or heredity or congenital origin has no place and should not be given consideration in deciding the question of whether or not a particular disability occurred subsequent to enlistment and in the line of duty, where said disability is discovered for the first time while the individual is in a duty

status subsequent to his enlistment in the naval service (L. R. N. A. 1929, p. 1019). The burden of proof lies upon those who would show that an individual was suffering from a disease prior to his entry into the naval service (L. R. N. A. 1929, p. 121).

Where it is the professional opinion of the medical officer that a disease is of accepted congenital origin and therefore existed prior to the individual's entry into the service, his professional opinion to that effect should be given as a fact which is to be considered in a final determination of any case. With the facts at hand he should then decide whether the disability was or was not incurred in the line of duty in accordance with the provisions of existing laws and regulations (L. R. N. A. 1929, p. 120).

> Where an enlisted man was discharged from the naval service because of "mental deficiency (moron)," it was considered that such disability was not incurred in line of duty for the reason that the beginning of this disability must be regarded as dating from early childhood and consequently existed prior to enlistment (C. M. O. 1–40, p. 82).
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> An enlisted man was discharged in June 1925, on account of "flat feet." At time of his enlistment in January 1925, he had been found to have "scoliosis, lowered arches," which, however, was not considered sufficient to disqualify him for enlistment. Since the disability which resulted in his separation from the naval service existed prior to his enlistment therein, held that it was not incurred in line of duty (C. M. O. 6–38, p. 11).
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> An enlisted man was admitted to the sick list for mental observation nine days after enlistment and was discharged from the naval service approximately 5½ months after enlistment for "psychoneurosis, neurasthenia" in accordance with the recommendation of a Board of Medical Survey. There was evidence that the man in question had suffered a serious head injury sometime prior to his enlistment. The Navy Department held that, in view of the very short period of time that this man was in the naval service prior to his admission to the sick list for mental observation and the definite evidence relative to the head injury, the disability which resulted in his separation from the naval service was not incurred in line of duty (C. M. O. 2–40, p. 186).

It is well at this point to review the Veterans' Regulations which are applicable. For compensation purposes where disabilities are incurred in line of duty or aggravated—in wartime—every person employed in the active military or naval service for 90 days or more, shall be taken to have been in sound condition when examined, accepted and enrolled for service except as to defects, infirmities or disorders noted at time of examination, acceptance, and enrollment, or where evidence, or medical judgment is such as to warrant a finding that the injury or disease existed prior to acceptance and enrollment. A preexisting injury or disease will be considered to have been aggravated by active military service where there is an

increase in disability during active service unless there is a specific finding that the increase in disability is due to the natural progress of the disease. For pension purposes where disabilities are incurred in line of duty or aggravated—in peacetime—every person employed in the active military or naval service for 6 months or more shall be taken to have been in sound condition when examined, accepted and enrolled for service, except as to defects, infirmities, or disorders noted at time of the examination, acceptance and enrollment, or where evidence or medical judgment is such as to warrant a finding that the disease or injury existed prior to acceptance and enrollment.

To emphasize the foregoing it is pertinent to note that in weighing claims for pensions the Veterans' Administration is authorized to give due weight to medical judgment as it concerns the origin of a disability or the natural progress of a disease. Furthermore the arbitrary proof of sound condition on enlistment is dependent upon the lapse of a period of 90 days in wartime and 6 months in peacetime.

With the foregoing in mind it is pertinent to note the following:

> Where the disability is, according to the best medical opinion, congenital in origin, or is the manifestation of an inherent weakness, either based on faulty hereditary endowment or previous adverse environmental experiences; even though not noted at the time of enlistment, and regardless of any legal presumption to the contrary, the fact that such disabilities must have existed prior to enlistment and are not of service origin should be recognized (Medicine and Surgery case No. P3-1517203).

In such cases effort should be made to obtain information relative to the patient's past history by questioning the patient and by communicating with the relatives or friends through the local Red Cross, if considered advisable, or by any other practical means for the purpose of obtaining definite and conclusive evidence that the disability had existed prior to enlistment and to rebut any legal presumption to the contrary. In this connection attention is invited to the confidential nature of information obtained through Red Cross social case histories.[15]

There is a certain class of cases such as clinical asthma (exclude the occupational type), hay fever, peptic ulcer, glycosuria, so-called orthostatic albuminuria and psoriasis, to mention a few which, because of their periodicity or seasonal nature, will be enlisted while symptom free. The mere denial of previous symptoms by such patients should not be considered as positive proof that the disability did not exist previously. In such cases where the history and findings of the episode under observation are indicative of a disability of long standing and are such that they have not resulted from conditions peculiar to the

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[15] Bureau of Medicine and Surgery Manual, appendix C, sec. VI, 2 (d).

naval environment it is desirable to obtain, where practicable, factual evidence to support or refute any denial of previous symptoms. Furthermore, where it is the professional opinion of the medical officer that a disease is of such nature it has been present for a long period of time and therefore existed prior to the individual's entry into the service, his opinion to that effect should be given as a fact which is to be considered in the final decision as to the origin of the disability.

The expressed opinion pertaining to service aggravation is important because the law granting pensions to ex-service personnel with service-connected disabilities reads in part as follows:

> For disability resulting from—aggravation of a preexisting injury or disease when such disability was incurred in or aggravated by active military or naval service—the United States will pay to any person thus disabled and who was honorably discharged from such period of service in which such preexisting injury or disease was aggravated, a pension as hereinafter provided, but no pension shall be paid if the disability is the result of the person's own misconduct.

In considering this question we must keep in mind what may be termed "the normal course" of a disability and it is pertinent to note whether the individual has sustained any disease, injury, or strain since enlistment which may have acted as an aggravating factor (Bureau of Medicine and Surgery case No. P3–1674279).

Since a decision that the disability was aggravated by service even though the disability itself was not incurred in line of duty would place the individual concerned in line for a pension, the Bureau is reluctant to approve reports of boards of medical survey showing that such disabilities have been aggravated by service unless there has actually been a permanent increase in the disability which can reasonably be attributed to service conditions (Bureau of Medicine and Surgery case No. P3–1640213). To determine service aggravation in this sense one must determine that the particular stresses in the military environment have brought about, in the sense of an occupational disease, an increase in the disability. It may be said to imply that an individual will be incapacitated to a greater extent following his discharge than he was prior to entering the service. This infers a permanent increase in the degree of disability. To justify such a finding the record must set forth evidence (Bureau of Medicine and Surgery case No. P3–1763793).

It is difficult to give a blanket definition of the term "aggravation by service" that can be applied to all disabilities. The temporary aggravation of symptoms caused by a chronic or permanent disability need not necessarily mean that the basic disability has been aggravated by service. Whether such a condition exists can only be determined after a reasonable period of observation and treatment. An opinion that a disability has been aggravated by service should

not be based solely on the patient's own statements regarding his disability, but should be supported by such evidence as demonstrable, structural, organic, or functional changes; or failure to obtain relief after a reasonable period of treatment (Bureau of Medicine and Surgery case No. P3–1640213).

A chronic condition, which is the continuation or manifestation of an underlying disease or state that existed prior to enlistment, and which has a tendency to run, more or less, what may be termed, "a normal course," growing progressively worse, often with intermittent periods of apparent quiescence, can hardly be considered as incurred in line of duty or representative of aggravation by service, unless the underlying abnormality could have been controlled under some other vocation.

Many of the medical surveys on personnel with short periods of service are concerned with the condition known as "constitutional psychopathic state." In this connection the Chief of the Bureau of Medicine and Surgery has stated:

> The term constitutional applied to a psychopathic state indicates that there are factors and processes present which originated from the individual's inherited or ingrained endowment and recruits who show up with such defects shortly after their entry into the service have constitutional and inherent weaknesses which unquestionably existed prior to their entry into service (Bureau Medicine and Surgery case No. P3–296237).

In many psychopaths the conflicts which precipitated hospitalization are essentially the same as the recorded episodes which occurred prior to enlistment. These conflicts are the expected expressions of the underlying personality defect and are an integral part of such a personality make-up. Service conditions may prove a favorable medium for their disclosure but there would appear to be no aggravation by service in many of these cases.

With a little extra work a longitudinal section of the social and occupational history can be procured to support the medical opinion that the disabilities existed prior to entry in the service, are not of service origin, and have not been aggravated by service (Bureau Medicine and Surgery case No. P3–1517203).

The trained psychiatrist classifies the unadaptable, emotionally unstable, queer, inapt individuals who present personality defects without physical or mental illness, as constitutional psychopaths. Their behavior is the result of inherited endowment or previous environmental experiences, or both, and is brought into the open, that is it becomes clinically manifest, whenever the individual is placed in a rigid critical community. There is usually nothing in such a person's service which has caused or aggravated his condition. Because service life demands a constant, rigid code of behavior and

continually exacts a high percentage output of one's capacity for work, it is a favorable medium for bringing these borderline or latent personality defects to light. When such a case is taken from general service and brought before the professional consultant he is placed under the full glare of a specially trained mind which is given to classification and diagnosis. The individual is labeled a psychopath according to the generally accepted criteria. Granted this is scientifically correct, it would appear reasonable and desirable to approach the labeling and disposition of these cases, not alone from this restricted viewpoint, but also in the light of social and community experience, more specifically in the light of the accepted standards of the community to which by birth and education he belongs and to which he will return after discharge. We must ask: "Where is this boy from?" "If discharged, where will he go?" "What will be his social and moral relationships in the community to which he expects to return?" Truly a man classed as a psychopath aboard the restricted and confined area of a man-of-war may be a "normal" member of a sleepy, country community. From this broader viewpoint many of these cases which we are classing as psychopaths, are, rather, administrative placement problems.

As a group, constitutional psychopaths are not unconscious of their actions and are not unmindful of the consequences thereof, and they may be held legally accountable. These cases usually present no physical or mental illness but a mal-adjustment problem based on a personality defect and if they demonstrate an inaptitude for the service they rate an inaptitude discharge. Under existing instructions there is authority to award inaptitude discharges and such disposition can logically be recommended in many of these cases.

In connection with recommendations for discharge, attention is invited to the Bureau's policy of not approving the discharge or release of patients who are or have recently been psychotic unless provision has been made for releasing them into the custody of some responsible individual with the knowledge and consent of the next of kin. There is no objection to such a recommendation on a survey report if the patient is delivered into the custody of the next of kin. However, a release, signed by such a person, should be obtained prior to the submission of the survey and noted thereon. If the next of kin is unable to take custody of the patient at the hospital, any other arrangements which are made must take into account the patient's interest as well as the public's and must be made with the full knowledge and written consent of the next of kin (Bureau of Medicine and Surgery file No. P3-1783104).

Although these psychotic cases represent individuals who are unfit for naval service they were accepted by the Navy and the

service has the moral responsibility of safeguarding the interests of the individual, his family and the community. Where there is nothing in the survey to indicate that steps have been taken in this direction it must be assumed these patients would be discharged on their own cognizance. This would be decidedly against the interests mentioned above. Such patients, if left to their own devices, fall easy prey to unscrupulous persons who may relieve them of their money, or otherwise defraud or endanger them. Such incidents are bound to produce adverse newspaper comment or other signs of public indignation. This is particularly unfortunate in the present emergency besides being against the best traditions of the service (Bureau of Medicine and Surgery file No. P3-1704857).

It may be noted further that the Bureau does not approve the return to duty of individuals with, or having a history of, clinically active tuberculosis,[16] coronary thrombosis, central nervous system syphilis, epilepsy, constitutional psychopathic state, psychoneurosis, psychosis, and other conditions similarly undesirable in service personnel.

The foregoing presentation of existing law and procedure has a bearing on the opinions expressed by boards of medical survey. The various decisions and regulations have been issued at intervals over a period of many years. During this time continuing changes have occurred in the laws and regulations, and in personnel with consequent modifications of policy. The decisions as to the origin of disabilities have necessarily been influenced by advancement in medical knowledge and changing social trends. A review of many medical surveys frequently reveals the fact that the Boards, by attempting to apply some particular legal concept, have arrived at conclusions, particularly with reference to the line of duty status of the disabilities, that are completely at variance with the facts of the case as included in the report. In expressing opinions as to the origin, or the service aggravation of disabilities, one should give due weight to every consideration applicable to the case. The opinions relating to the origin of disablities are supposed to be drawn from the history of the case and the facts presented in the report. They should be consistent with the record and with existing law. In expressing their opinions the members of the Board must take into account the interests of both the individual and of the government. They definitely should adhere to the principles of good sound medical judgment. In those cases not qualified for retention the survey report serves as the vehicle for effecting their separation from the service. This is the factor of immediate concern to the Navy Department. We must not, however, lose sight of the ultimate effect, that is, the cost to the government and to the taxpayers.

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[16] Bureau of Medicine and Surgery Manual, par. 2122 (a).

THE EFFECTS OF CERTAIN DETERGENTS ON INFLUENZA VIRUS (TYPES A AND B)[1]

LABORATORY RESEARCH UNIT NO. 1[2]

By Commander Albert P. Krueger, Medical Corps, United States Naval Reserve and Unit Personnel[3]

It was shown by Smith, Andrewes, and Laidlaw (1) in 1933 that the causal agent of influenza is a filterable virus which can be recovered from the throat washings of patients in the acute phase of the disease by intranasal inoculation of ferrets. Fortunately, in view of the fact that ferrets are expensive and often difficult to obtain, the ferret passage virus is readily adapted to mice. Direct transfer of virus from the human to the mouse without the intermediate step of ferret infection is not ordinarily successful although it can be accomplished on occasion (2). Evidence is now accumulating that the virus can be recovered by inoculation of the chick chorioallantoic membrane with human material (3).

Once a means of isolating influenza virus was at hand, laboratories all over the world undertook the vast amount of systematic experimentation necessary to clarify the epidemiological, serological, and immunological relationships involved. It has been possible to isolate many different strains of virus, to carry them successfully through hundreds of mouse passages and through equal numbers of passages in the chorioallantoic membrane of the developing chick embryo and finally to prove that the cultivated virus preparations are capable of inducing clinical influenza when inoculated into human volunteers (4).

The most frequently isolated virus has been designated influenza virus, "type A", which includes numerous serologically differentiable strains related through possession of common antigenic factors. An entirely distinct influenza virus of low virulence was isolated by Francis (5) in 1940. There is acceptable serological evidence that it has been involved as the etiologic agent in certain epidemics of 1936 and 1940 in the United States and that it is antigenically unrelated to type A strains. This virus is known as the "Lee strain" or "influenza virus type B." Besides these A and B viruses it is entirely possible that other distinctive types may be isolated eventually.

Studies on the nature of influenza virus have indicated that the

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actual infectious units are of approximately $6\mu\mu$ diameter but that in the commonly used suspensions of ground mouse lungs these particles are associated with fragments of normal tissue elements, the complex as a whole measuring about $100\mu\mu$ in diameter (6).

It has been of both theoretical and practical interest to determine the effects of various chemicals on influenza virus. Among the agents about which information is particularly desirable because of their constant application to clinical practice, are the detergents. Stock and Francis (7) have already observed that oleic, linolic, and linolenic acids slowly inactivate 1 percent suspensions of influenza virus (PR-8 strain) at pH 7.5. Other fatty acids were less effective as inactivating agents. We wish to present here the results of experiments undertaken to ascertain the effect of zephiran, oakite No. 63, tergitol penetrant No. 7, and soap solutions on types A and B influenza viruses.

MATERIALS AND METHODS

Viruses.—The type A virus used was the PR-8 strain maintained by passage in mice. For our experiments virus suspensions were made from the lungs of infected mice (352d to 357th passage) by grinding the tissues with alundum and adding 10.0 cc. of broth at pH 7.6 for each gram of lung. This constituted the "10 percent lung suspension", which was employed directly or from which lower concentrations were prepared by dilution in broth. 0.05 cc. of the undiluted material contained a minimum of 1×10^{5} M. L. D.'s as titrated by the intranasal inoculation of mice. (8)

The type B influenza virus (Lee strain) was maintained in mice, and lungs from the 85th to the 96th passages were prepared as a source of virus according to the procedure outlined above. 0.05 centimeter aliquots of the undiluted 10 percent suspensions had titres ranging from 1×10^{5} to 1×10^{6} M. L. D.'S.

TEST SOLUTIONS

1. Zephiran is a mixture of high molecular alkyl-dimethyl-benzyl ammonium chlorides with the general structural formula:
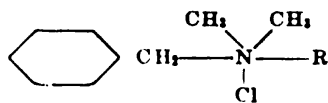
intranasal inoculation of mice (8).

2. Tergitol penetrant No. 7 is a wetting agent recommended for general use as a detergent. Chemically it consists of the sodium salt of higher secondary alkyl sulfate, the alkyl radical being: 3, 9 diethyltridecanol-6. Dilutions were prepared in physiological saline solution.

3. Oakite No. 63, a commercial detergent powder containing tri-sodium phosphate, is commonly used in dishwashing. Various dilutions of the compound were prepared in physiological saline solution.

4. Soap solution.—Ivory soap was selected as a representative of this class of detergents and was prepared as a 2 percent solution of the ordinary cake in distilled water. Lower concentrations were made by diluting with distilled water.

PROCEDURE FOR TESTING

Various dilutions of the detergents were mixed with equal volumes of virus suspensions and the mixtures were maintained at room temperatures. In the case of the undiluted type A virus-detergent mixtures, a volume of 0.05 cc. represented a minimum of 50,000 M. L. D.'s of virus while the corresponding type B virus-detergent mixtures contained a minimum of 500 M. L. D.'s. At intervals samples were removed and aliquots of 0.05 cc. were administered to mice by the intranasal route. Three mice were used for each detergent dilution and for each time interval. The animals were observed over a 10-day period and those dying were autopsied at once. Records were kept of the days of death and the number of lobes found to be consolidated in each animal's lungs. Mice surviving 10 days were sacrificed and the extent of pulmonary lesions determined.

For each experiment the following controls were included (in addition to the original titration of the virus suspensions):

1. Intranasal inoculation of three mice with each virus dilution employed.
2. Intranasal inoculation of three mice with each detergent under investigation.

EXPERIMENTAL RESULTS

Zephiran.—While a 10 percent solution of this compound was available it was not possible to use concentrations greater than 1 part in 10,000 with influenza virus preparations because of the formation of precipitates. Mixtures of each of the 2 viruses and zephiran diluted in physiological saline solution were prepared, the final concentrations being:

1. PR–8 influenza virus 5 percent + zephiran 1 : 10,000
2. PR–8 influenza virus 5 percent + zephiran 1 : 100,000
3. PR–8 influenza virus 0.5 percent + zephiran 1 : 10,000
4. Lee strain influenza virus 5 percent + zephiran 1 : 10,000

As recorded in table I, a concentration of 1 part of zephiran in 1,000 produced no pulmonary lesions when administered intranasally to mice. 1 : 10,000 zephiran acting at room temperature for 1 hour on 5 percent lung suspensions of types A and B viruses failed to inactivate them. The same concentration of zephiran did not destroy the infectiousness of a more dilute (0.5 percent) lung suspension PR–8 virus.

TABLE I.[1]—*The effect of zephiran on types A and B influenza viruses*

Concentrations of virus and zepheran in test mixtures		Infectivity of mixtures after stated intervals of contact							
Virus	Zepheran	20 minutes			40 minutes			60 minutes		
PR–8 strain, 5 percent	10⁻⁴	4	5	5				4	4	7
PR–8 strain, 5 percent	10⁻⁵				4	4	4	3	4	4
PR–8 strain, 0.5 percent	10⁻⁴	6	6	K₄	5	6	6	6	7	K₁
Control, 0.5 percent	0							3	4	7
Lee strain, 5 percent	10⁻⁴	6	8	9				4	6	6
Control, 5 percent	0							4	6	7
0	Control 1/1,000							K₀	K₀	K₄

[1] The numerals indicate the day of death of individual mice. K signifies animal killed on tenth day after inoculation and subscript refers to number of lobes found consolidated.

Tergitol Penetrant No. 7.—Tergitol penetrant No. 7 in concentrations ranging from 1:20,000 to 1:2,000 did not completely inactivate PR–8 or Lee strain viruses in 5 percent suspensions within the hour period of exposure. However, 1:2,000 Tergitol solution after 60 minutes of action on dilute virus suspension (0.5 percent) reduced the activity of the latter, i. e., instead of the mice dying in 4 to 6 days they were still alive after the expiration of 10 days and upon being sacrificed at that time only two lobes of each animal's lungs were found consolidated. Tergitol solution 1:1,000 administered intranasally did not kill the mice nor did it cause pulmonary consolidation.

TABLE II.[1]—*The effect of tergitol penetrant No. 7 on types A and B influenza viruses*

Concentrations of virus and tergitol in test mixtures		Infectivity of mixtures after stated intervals of contact		
Virus	Tergitol	20 minutes	40 minutes	60 minutes
PR–8 strain, 5 percent	1/2,000	3　4　5	3　6　6	4　6　6
PR–8 strain, 5 percent	1/10,000	6　6　K4	4　4　6	3　5　5
		3　3　4	----------	4　6　6
PR–8 strain, 5 percent	1/20,000	6　K4　K4	----------	4　6　6
PR–8 strain, 0.5 percent	1/2,000	----------	6　9　K4	K2　K2　K2
PR–8 strain, 0.5 percent	1/10,000	5　6　6	6　6　6	5　6　6
Control, 0.5 percent	0	----------	----------	4　6　6
Lee strain, 5 percent	1/1,000	8　9　K4	----------	7　8　K0
Lee strain, 5 percent	1/10,000	7　7　9	----------	5　7　8
Control, 5 percent	0	----------	----------	4　6　7
Control, 0	1/1,000	----------	----------	K0　K0　K0

[1] See footnote on table 1.

c. Oakite No. 63.—Oakite No. 63 in 1:100, 1:200, and 1:10,000 dilutions failed to inactivate 5 percent PR–8 virus suspension within 1 hour. 1:100 Oakite No. 63 solution showed some inactivation of 5 percent type B virus suspension. After 1 hour of exposure to this concentration of Oakite, 1 out of 3 animals inoculated intranasally did not develop any pulmonary consolidation and each of the other two had only two lobes involved. The control animals receiving 1:100 Oakite solution alone, lived and when autopsied after 10 days showed no lung lesions.

TABLE III.[1]—*The effect of Oakite No. 63 on types A and B influenza viruses*

Concentrations of virus and Oakite No. 63 in test mixtures		Infectivity of mixtures after stated intervals of contact		
Virus	Oakite No. 63	20 minutes	40 minutes	60 minutes
PR–8 strain, 5 percent	1/100	7　4　5	----------	3　6　9
PR–8 strain, 5 percent	1/200	4　4　5	4　5　6	4　4　6
PR–8 strain, 5 percent	1/10,000	4　4　K2	----------	4　5　5
Control, 5 percent	0	----------	----------	4　5　6
Lee strain, 5 percent	1/100	K2　K4　K4	----------	K0　K2　K2
Lee strain, 5 percent	1/1,000	5　6　K4	----------	6　6　7
Control, 5 percent	0	----------	----------	4　6　7
0	Control, 1/100	----------	----------	K0　K0　K0

[1] See footnote on table 1.

Soap Solution.—The most concentrated soap solution (1 percent) did not completely inactivate the virus in a 5 percent lung suspension of PR–8 strain although after 40 minutes exposure there appears to have been partial inactivation, i. e., the mice survived the 10-day period of observation and when autopsied revealed three consolidated lobes in two animals and four in the

third. Similar results were noted with 0.1 percent soap solution while lesser concentrations of soap seemed completely ineffective. When 0.05 percent lung suspension of PR–8 virus was used as a test material the latter was destroyed by 1 percent soap solution in 15 minutes. Even 0.1 percent soap solution inactivated nearly all the virus in 15 to 25 minutes and after 40 minutes the mixture had lost all capacity to produce lung lesions in mice. 0.01 percent soap solution showed some slight inactivating effects but 0.001 percent did not.

TABLE IV.[1]—*The effect of soap solution on types A and B influenza viruses*

Concentrations of virus and soap in test mixtures		Infectivity of mixtures after stated intervals of contact		
Virus	Soap	15 minutes	25 minutes	40 minutes
	Percent			
PR–8 strain, 5 percent	1	5 6 6	7 7 K_3	K_4 K_3 K_3
PR–8 strain, 5 percent	0.1	3 4 4	4 4 6	10 K_2 K_3
PR–8 strain, 5 percent	0.01	3 4 5	4 4 7	5 7 K_1
PR–8 strain, 5 percent	0.001	4 5 K_2	5 6 6	3 10 K_1
PR–8 strain. 0.05 percent	1	K_0 K_0 K_0	K_0 K_0 K_0	K_0 K_0 K_0
PR–8 strain. 0.05 percent	0.1	10 K_0 K_0	K_0 K_0 K_0	K_0 K_0 K_0
PR–8 strain. 0.05 percent	0.01	7 8 K_2	K_2 K_2 K_0	8 K_3 K_0
PR–8 strain. 0.05 percent	0.001	6 7 7	5 6 8	5 5 7
Control, 0.05 percent	0	------------	------------	4 5 6
0	[2] 1			K_0 K_0 K_0
Lee strain "B", 5 percent	1	K_2 K_1 K_0	K_2 K_3 K_0	K_0 K_0 K_0
Lee strain "B", 5 percent	0.1	7 9 K_1	4 5 K_2	4 7 8
Lee strain "B", 5 percent	0.01	4 7 K_0	5 6 9	5 7 8
Lee strain "B", 5 percent	0.001	5 6 6	6 6 7	5 7 8
Lee strain "B". 0.05 percent	1	K_0 K_0 K_0	K_0 K_0 K_0	K_0 K_0 K_0
Lee strain "B". 0.05 percent	0.1	K_0 K_0 K_0	K_2 K_0 K_0	K_0 K_0 K_0
Lee strain "B". 0.05 percent	0.01	10 K_1 K_3	9 10 K_1	11 K_4 K_4
Lee strain "B". 0.05 percent	0.001	7 9 10	8 9 10	9 9 10
Control, 5 percent	0	------------	------------	3 4 5
Control, 0.05 percent	0	------------	------------	7 8 8

[1] See footnote on table 1.
[2] Control.

TABLE V.—*pH values of detergents and detergents mixed with influenza virus suspension (PR–8 strain)*

Dilution	Virus only		Zephiran		Zephiran+virus		Tergitol			Tergitol+virus	
	10 per-cent	1 per-cent	1/500	1/5000	Zephiran. 1/1000; virus, 5 percent	1/1000, 0.5 per-cent	1/500	1/2500	1/5000	Tergitol, 1/1000; virus, 5 percent	1/1000, 0.5 per-cent
pH	6.5	6.6	7.5	7.0	6.6	6.85	6.4	6.45	6.7	6.5	6.55

Dilution	Oakite No. 63	Oakite+virus		Soap				Soap+virus			
	1/50	Oakite, 1/100; virus, 5 per-cent	1/100, 0.5 per-cent	2 per-cent	0.2 per-cent	0.02 per-cent	0.002 per-cent	Soap, 1 per-cent; virus, 5 per-cent	1 per-cent, 0.5 per-cent	0.1 per-cent, 5 per-cent	0.1 per-cent, 0.5 per-cent
pH	11.7	10.55	11.2	9.45	9.2	7.25	6.65	7.95	8.4	6.9	7.5

In the case of type B virus in 5 percent lung suspension, 1 percent soap solution destroyed some of the virus within 15 minutes but it required 40 minutes to render the mixture noninfectious. Higher dilutions of soap were not demonstrably effective. Against 0.05 percent type B virus a 1 percent

soap solution produced complete destruction of virus in 15 minutes. The 0.1 percent soap solution was nearly as effective and even the 0.01 percent solution showed some action. 0.001 percent soap solution appeared to be without great influence on the virus.

One percent soap solution instilled intranasally into mice did not kill them and when the animals were autopsied after 10 days of observation there were no lung lesions.

Since Stock and Francis (7) found that influenza virus is readily inactivated within 1 hour at pH values below 5.0 or above 10.0, it was considered important to ascertain the H-ion concentrations of the virus-detergent mixtures used in the present experiments. Table V lists the data obtained with a glass electrode. Of the solutions tested only the Oakite-virus mixtures were definitely above the pH limit of 10.0.

DISCUSSION

Zephiran is a detergent compound possessing a cationic hydrophobic group. It markedly lowers surface tension and is said by Walter (9) to display detergent, keratolytic, emulsifying, and emollient properties. Other workers have reported on its efficacy as a germicide (Domagk (10), Maier (11), Thompson, Isaacs, and Khorazo (12)). At 20° C. the highest dilution destroying Staphylococcus aureus or Eberthella typhi in 10, but not in 5 minutes, is 1:20,000 and the corresponding dilution for Streptococcus hemolyticus is 1:40,000. In tests conducted by Krog and Marshall (13) a 1:5,000 dilution of zephiran was found to markedly reduce the bacterial contaminants on eating and drinking utensils within one minute. Further, the bactericidal power of zephiran is not materially impaired by the presence of serum in concentrations less than 50 percent (14).

Altogether then, one might anticipate that this compound would exert considerable virucidal effect on influenza virus. However, 1:10,000 zephiran failed to inactivate either type A or type B virus strains within the hour period of exposure.

Tergitol penetrant No. 7 contains as its active principle sodium alkyl sulfate in which the alkyl radical is: 3.9-di-ethyltridecanol-6. Miller and Baker (15) have noted that a 1:3,000 dilution of tergitol penetrant No. 7 completely inhibits the metabolism of gram-positive organisms but has no appreciable effect on gram-negative bacteria. While some of the tergitols are moderately bactericidal for gram-positive organisms in an acid environment (16) there appears to be no indication that they possess strong germicidal properties. Because of their ability to reduce surface tension their use has been suggested as a means of enhancing the efficiency of recognized germicides (17).

When tested for virucidal effect on 5 percent suspensions of PR–8 and Lee strains of influenza virus there was no inactivation even after 1 hour of exposure to 1:2,000 tergitol. In the case of more dilute PR–8 virus (0.5 percent) the 1:2,000 dilution in 1 hour reduced the potency of the suspension to the point where it did not kill the test mice but instead caused the consolidation of only two lobes in each animal.

Oakite No. 63 is commonly employed as a detergent in dishwashing and no claims are made by the manufacturers with respect to germicidal properties of the product. The component responsible for its effectiveness is tri-sodium phosphate. Concentrations up to 1:100 did not destroy 5 percent PR–8 virus suspensions within one hour. However, mixtures containing 5 percent Lee strain virus and 1:100 Oakite No. 63 exhibited some loss of infectivity after 20 minutes and in 1 hour very little virus was left in the active state.

Simple soap solution strongly inactivated the more dilute preparations of both type A and type B influenza viruses. This effect was noticeable within 15 minutes when the soap concentration was above 1 part per 1,000. After 40 minutes of exposure the heavier suspension of type B virus (5 percent) was entirely destroyed by 1 percent soap solution. This same concentration of soap only partially inactivated the 5 percent type A virus preparation after 40 minutes. It is probable that the greater susceptibility of type B virus (5 percent suspension) to the action of soap depends upon the fact that the initial titre of the suspension is much lower than that of the type A virus preparation. Nichols (18) observed, by way of comparison, that a 0.5 percent solution of ordinary brown laundry soap killed H. influenzae and pneumococci within ½ minute, streptococcus pyogenes in 5 minutes, and had no detectable effect on staphylococcus aureus or E. typhi after 10 minutes of exposure.

Among the compounds tested the only one which attained a pH in solution sufficient to inactivate influenza virus was Oakite No. 63. The Oakite-virus mixture had a pH of 10.55 and in the experiments of Stock and Francis (7) it was found that influenza virus is extensively inactivated in 1 hour or less when the pH rises above 10.0. Nevertheless, the 5 percent suspension of PR–8 virus mixed with 1 percent Oakite No. 63 was capable of killing mice in the usual length of time when tested 1 hour after mixing.

The experimental results reported above have some practical bearing on the problem of the spread of infectious agents through inadequate dishwashing. When eating utensils are washed in properly operated modern machines there is no real problem involved. Surface films and deposits of foods are completely removed by efficient mechanical and detergent action. Subsequently the utensils are

exposed to relatively large volumes of water at temperatures which are high enough to destroy all the common pathogenic organisms and viruses.

In the case of manual washing with any simple cleansing powder, food remnants, surface deposits of various sorts, and associated infectious agents are removed from the exposed utensils and become suspended in the solution. With the temperature sufficiently high and the period of treatment long enough, the pathogenic bacteria and viruses are destroyed at this point, but even if destruction does not proceed to completion most of them are disposed of through frequent changing of the cleansing solution. Any residual disease agents are dealt with by chlorination, by thermal inactivation, or by dilution in a large volume of rinse water.

This procedure is both theoretically and practically sound, it requires no great outlay for equipment, and its satisfactory application is not limited to a particular product, but may be extended to any efficient detergent. Nevertheless, satisfactory sanitization of eating utensils in fountains, bars, and restaurants is admitted by sanitarians to be one of their most troublesome problems (19). The tendency, all too frequently, is to use volumes of water that are too small for the utensil load, inadequate temperatures, or insufficient chlorination with very cursory rinsing and to rely upon the cleansing agent to sterilize the dishes, glasses, etc.

Various public-health hazards attributable to such practices are well recognized and our data merely serve to establish another possible source of danger when the cleansing agent is expected to sterilize. The representative detergents tested failed to destroy influenza virus when acting over longer periods of time than those customarily employed in dishwashing. Although one of these agents, zephiran, has marked germicidal properties it did not inactivate types A or B influenza virus, thus emphasizing once again the difficulties that exist in predicting the action of germicidal compounds on viruses.

These remarks indicating how residual influenza virus can survive dishwashing if the procedure is not properly conducted and if undue reliance is placed upon the virucidal activity of detergents, may be qualified by consideration of the way in which the virus normally is dispersed through a population. Certainly the major mechanism of spread is through the coughing and sneezing of infected individuals with resultant dissemination of virus-containing droplets and smaller nuclei through the atmosphere. Ingress of the virus carried by air is almost universally through the respiratory tract of the victim and it is not certain just how important active virus left on eating utensils and subsequently introduced into the mouth would be as a source of

infection. At any rate such deposits are potentially dangerous, and efforts to eradicate them are not misdirected.

SUMMARY AND CONCLUSIONS

1. Representative detergents were tested for their capacity to inactivate influenza viruses types A and B, including:

    (*a*) Alkyl-dimethyl-benzyl-ammonium chlorides (zephiran).

    (*b*) The sodium salt of 3, 9 diethyltridecanol-6 sulfate (tergitol penetrant No. 7).

    (*c*) An alkaline cleansing agent containing tri-sodium phosphate (Oakite No. 63).

    (*d*) General purpose soap solution (Ivory soap cake).

2. Despite its well-established bactericidal properties for organisms such as staphylococcus aureus or E. typhi, zephiran failed to inactivate the test virus preparations even after 1 hour of exposure to a concentration of 1:10,000.

3. Tergitol penetrant No. 7 in concentrations as high as 1:2,000 did not destroy the viruses in dense lung suspensions. With dilute virus preparations there was measurable inactivation after 1 hour.

4. A 1-percent solution of Oakite No. 63 was ineffective against concentrated type A virus although the pH of the mixture (10.55) was well beyond the viruses' stability range. The activity of type B virus mixed with 1-percent Oakite No. 63 was definitely reduced.

5. A 1-percent soap solution rendered dense lung suspensions of type B virus noninfectious within 40 minutes but only partially destroyed the corresponding type A virus preparation. Dilute viruses of both types were entirely lacking in infectiousness after being in contact with 1-percent or 0.1-percent soap solution for 15 minutes. Lower concentrations of soap displayed only partial and irregular inactivating capacity.

6. The practical significance of these data with respect to public-health problems involved in the manual washing of eating utensils is discussed.

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CONSTITUTIONAL FACTORS IN THE SELECTION OF RECRUITS

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Recruit selection has always operated on the principle that any young man of sound body and reasonable intelligence could be made, with the proper amount and kind of training, into a good sailor. In peacetime the fallacy of this principle was not obvious because there was plenty of time for variants in constitutional make-up and temperamental capacities to find their own levels as to duties that they could perform with satisfaction or as to assignments to the various naval environments to which they could adjust themselves with contentment. If they could not reach their levels, they could ultimately

be discharged and the loss of time and the wasted training and the nuisance value of the misfits were not counted as anything very serious.

The present necessity of enlisting large numbers of men, cutting short their training, and sending them out to situations requiring considerable responsibility and technical skill has resulted in the assignment of large numbers of men to duties for which they are obviously unsuited. These men are failing not because they are physically defective or because they lack the intellectual equipment with which to cope with their problems, but because they are temperamentally and emotionally inadequate to the situation.

This fact of large numbers of failures in the service does not necessarily mean that these men should not have been enlisted but that, during the period of training, a greater effort should have been made to determine their temperamental qualities or their behavior capacities in order that duties could be selected for them in which they had some possibility of succeeding, and that those who were not at the moment adequate to a duty could be given sufficient time and further training, in preparation for it. If we should eliminate from the service all those who show so-called neurotic traits or who at the moment do not seem entirely adequate, a large group of potentially good recruits would be lost from the service.

Two obvious criticisms of attempts to select on the basis of temperamental characteristics present themselves. The first is that there is insufficient time to make any estimation of temperament; and the second, that we have an insufficient knowledge of the factors making up temperament to form any valid judgments.

An attempt has been made at the Portsmouth Naval Hospital to study this problem. Two groups were studied, the first composed of those who had obviously been successful in their adjustment to naval life, and the second, those who had been obvious failures. The material for the successful group was derived from a submarine crew who had been together for some time, and who, the commanding officer felt, formed a fairly representative group; and from a group of hospital corpsmen from the Portsmouth Naval Hospital. The corpsmen had ratings and positions of responsibility indicating their successful adjustment. The men were all interviewed individually, and, in addition to a history of their background, they were all asked what qualities they would look for in choosing men for their branch of the service. The qualities they enumerated reflected to a considerable degree their estimation of themselves and could not be considered entirely objective, but, because of their own success and the diversity of the individuals interviewed, it was felt that the qualities listed were sufficiently significant.

Below is a list of qualities given by the men who were successful in submarine work and hospital corps work:

SUBMARINE MAN

1. Maturity: Must be able to take care of himself; must be able to take responsibility.
2. Intelligence: High school level.
3. Must know how to mix; must be able to get along with people; must not be forward.
4. Must be physically rugged; must be able to stand changes in temperature, irregular diet, irregular and long hours of work, conditions of poor ventilation.
5. Must not be nervous, anxious.
6. Must be patient, not need a lot of exercise; must not be restless.
7. Must understand discipline; must understand his place without being told and must not take advantage of the informality of the life.
8. Must be aggressive, eager, and anxious to get ahead.
9. Must be quick.
10. Must be clean.
11. Must be a worker.
12. Must be honest.
13. Must have regard for the feelings of others.
14. Must not be too moral.

HOSPITAL CORPSMAN

1. Intelligence: High school level.
2. Must have personal pride, be neat and clean.
3. Must be obedient.
4. Must be interested in hospital work.
5. Should have had past experience with similar work.
6. Must be honest, exact.
7. Must be eager, curious, alert, ambitious.
8. Must be quiet, not restless.

The group which had failed to adjust were drawn from apprentice hospital corpsmen and from prisoners in the Portsmouth Naval Prison who were 20 years old or under.

List 1 gives the summaries of interviews with 10 corpsmen who had either been repeatedly on report or who had been found inadequate to their duties and shows the temperamental qualities and personality traits found in these poorly adjusted individuals.

LIST 1

1. Seems a simple, likeable individual, who at his own level will do fairly satisfactory work. Recommend transfer to seaman or fireman rating.

2. Not very good material, but considering probable early over-protection and low intelligence, he is not doing badly.

3. Cyclothymic make-up. Capable of both excitement and depression. Insecure, anxious. Instincts and ideals poorly integrated with poor ego formation.

4. Excitable, stubborn boy, with poorly developed affect and not constitutionally well endowed in this capacity. Will need a great deal of supervision and personal interest. Recommend outside detail for a while and then return to ward.

5. Well-developed, powerful individual with great energy and very strong, deep emotions. Many of his attitudes result from a not too happy childhood. Many of his attitudes are quite mature but good emotional control has not yet

been established. Wants hard work, challenges to his self-responsibility, and firm, interested, patient leadership. Wants submarine duty and has considered the physical and emotional hazards. Boy seems to have great potential value. Would recommend transfer out of hospital to active duty at sea.

6. Poor material for Navy.

7. Poorly adjusted, withdrawn, irritable, with considerable depth of mood. Unable to project emotions. Preschizophrenic.

8. Poor somatic material. Poorly developed. Probably inadequate to duty. Feels nervous, cries easily. Homesick and lonely. Has no friends.

9. Simple, childish, dependent, restless, and diffuse. Will probably never make a good corpsman.

10. Simple, poorly balanced, unstable, insecure individual. Certainly not hospital corps material. Might possibly get by in a protected situation. Boy is not good naval material.

List 2 gives the summaries of the interviews with 10 prisoners and again shows the traits and qualities found in these individuals. It is interesting to note the similarity of traits and qualities in the 2 groups showing that there is a common denominator of inadequacy and there is a large element of chance and circumstance in whether the individual continues to get by on a low level, becomes a hospital patient or ends up in prison.

LIST 2

1. Outstanding features are strong drives to aggression and sexual satisfaction together with poor affect, so that no sublimation in socially acceptable patterns is possible. Intelligence has never been used beyond immediate satisfaction of drives. Said he thought there must be something the matter with him because he always had such hard luck.

2. Constitutionally poor material and his environment has made him operate at his minimum rather than at his maximum. Doubtful if he would even make a good soldier.

3. Underdynamic, sensitive, introspective boy who is essentially poor service material. With more maturity and guidance might make fair corpsman. Was too immature to carry the load of emotional responsibility with which he saddled himself. Interview with wife by some member of staff might help his future.

4. Hyperirritable, sensitive, sensory individual, with very little control over his instinctual reactions. Dependent, affectionate, will need plenty of activity, friendliness and stimulation. Efforts should be made to stimulate his intellectual processes and allow him to sublimate some of his instinctual desires. Must learn emotional control.

5. Underdynamic individual with poorly controlled instincts. Poor psychological control. Enuresis. Poor social relations. Poor standards and convictions which are readily soluble in alcohol.

6. Boy is blocked, repressed, withdrawn. Affect is inappropriate and inadequate to thoughts expressed. Irritable, frequently smiles in silly way. Impresses as preschizophrenic and worthy of close watching.

7. Underdynamic, weak, immature boy without drive, ambition or intellectual interest. Soft, dependent, sensitive. Work should be towards an emotional

goal, admiration for some adult person with development of ideals and conviction. Has good social sense which should be utilized.

8. This boy is definitely preschizophrenic and needs careful watching and guidance. Needs occupation and guidance with it.

9. Large, soft, characterless individual who is emotionally unstable. Needs development of more hardness, conviction and ability to sustain his convictions. Would think facing fairly hard physical tasks from which he could not withdraw or put the burden on others might help.

10. Slow sensitive boy who has been through many emotionally traumatic situations. Strong instinctual desires, with considerable autonomic instability making their control difficult. Little opportunity for development of ideals but boy has surprising feeling for the physical world and has been not too much spoiled by his contact with the human being.

It is obvious that these qualities represent a combination of inherent constitutional characteristics and the results of environment and training. It is equally true that it is the inherent characteristics that condition an individual's reaction to his environment and that he can only react to this environment within the limits of his constitutional make-up, and that if he is to possess these qualities, he must have certain inherent characteristics to serve as a basis of the desirable qualities. Conversely, if he does not possess them but has the fundamental qualities, then training and reeducation will enable him to develop them. There will never be time in recruit selection to make a complete analysis of the background, but if we can get at the inherent capacities, we can at least know whether the material is sufficiently good to work with and whether there are present characteristics which will make certain phases of naval life difficult or impossible for the individual.

The six characteristics listed below are regarded as being necessary to survival and reproduction, as being transmitted by inheritance, as varying in the degree to which they are possessed by any individual, and as being subject to modification by disease and other environmental conditions.

1. Physical make-up.
2. Irritability—the speed of reaction to stimulation of reflex patterns or instincts and the intensity of the feelings accompanying the stimulation of these patterns.
3. Energy or drive—the capacity to sustain and carry to a successful conclusion the reflex patterns or instincts which have been stimulated.
4. Affect—the ability to enjoy and understand human relationships, to feel affection, sympathy and loyalty, to be able to modify one's own feelings for the sake of better relationships.
5. Mental activity—curiosity, alertness, interest.
6. Intelligence—capacity to learn, to remember.

It is possible in a 15-minute interview to make a fair estimate of the degree to which these characteristics are possessed by any given individual. They are characteristics recognized by every trainer or breeder of dogs and horses. The persistence of accentuation or

diminution of these temperamental characteristics in certain blood lines is made a basis of breeding, and plans of training take place around these characteristics as fixed points.

In the determination of physical efficiency, functional examination must be added. In the determination of the first item of physical make-up, the ordinary static examination, as done in the recruit station, does not actually reveal or answer the questions that must be known to determine the individual's ability to handle situations requiring hard work, persistent effort, exposure to temperature changes, and severe muscular activity, so that functional tests of cardiac function under effort, pulmonary capacity, a short gastro-intestinal history, and any other questions designed to reveal the functional capacities of the various organ systems are important.

In studying speed of reaction, whether to a simple single reflex or a complex pattern belonging to the group of instincts, we want to know, beside the speed with which it is set off, whether its function is accompanied by feelings of excitement, fear, anger, somatic symptoms of headache, dizziness, palpitation, flushing, sweating, tachycardia, nausea, hyperperistalsis, vomiting, diarrhea; whether stimuli to the reproductive patterns reveal stability or instability, are well controlled or poorly controlled. History will reveal a good deal of it. The recruit's behavior during the psychiatric interview, his behavior with his fellows in the barracks, his reactions under restriction, criticism, pressure of one kind or another, the speed with which he obeys orders, his ability to get along on a ship, his sleep, his reaction to diet, the number of times he comes to sick call, all will have a bearing on the factor of irritability. Test situations can be set up which might produce anger, fear, excitement, or resentment and the recruit can be deliberately placed in these situations.

Energy and drive again can be determined by a short history of the recruit's interests, the persistence with which he has held a course of behavior, his athletic activities, the kind of jobs he has looked for, his endurance during recruit training; and there again test situations for the individual's ability to sustain effort can be easily devised.

Affect can be easily brought out by the recruit's story of his family relationships, his friends, both boy and girl, social activities, attitudes toward the war, reasons why he came into the service, etc.; and confirmation of this may be obtained by observation of his relationships with the other recruits, whether he becomes dependent on the approval of other people, whether he is able to handle himself independently, make his own decisions, whether he is a leader or a follower, whether he appears considerate of others and gives way to the desires of others or whether he is continually trying to put himself in front and to protect himself.

Mental activity can be determined through a short history of the recruit's interests, his school progress, his views on and knowledge of current topics, and again, the interest and curiosity which he displays in learning during his training period, the intelligence of his questions, and his ability to learn new technics.

Intelligence can be readily and fairly accurately determined by well standardized tests.

The first three of these six capacities controlling and forming the basis for the instinctual level of behavior, are the strongest motivating forces in behavior, and are possessed by all members of the animal world. The social, cultured, intelligent human being is produced by the integration and control of these capacities by the other three of affect, mental activity and intelligence. These capacities do not operate in an isolated way but by virtue of their integration with other capacities to form total behavior, so that a wide degree of compensation is possible, and, where an individual is high in irritability and excitability, a high intelligence and a desire for good human relationships will help him to control this. An individual of relatively low intelligence who is alert, not excitable, and has adequate energy can become an extremely useful citizen. And so there are all possible combinations of these six capacities which produce the tremendous range of human variants, and it is a matter of estimating the degree to which an individual possesses them, the way in which he has integrated one quality with another, in order to determine the probable degree to which he is subject to modification and thereby his ability to make a better adjustment to service conditions.

What, then, is the relationship of these fundamental capacities to the desirable qualities of submarine men and hospital corpsmen listed above? What qualities go into developing maturity? It is obvious that the hyperirritable, sensitive, easily stimulated individual is going to have a more difficult time in emancipating himself from the protection of his family, friends and community than the more phlegmatic recruit who takes things as they come and is not easily disturbed. Again, the individual with high affect, who has been dependent on the relationships with the people about him, his family and friends, may find himself lonely and unhappy in the recruit situation. The most mature men are those who are not above average in the capacity of irritability, are physically adequate, have average energy or drive, are not too dependent on human relationships, and have had some experience in taking care of themselves in an independent situation.

The ability to understand and accept discipline is really related to maturity, but the highly energetic, restless, driving individual has a much greater problem in restraining himself and accepting

routine discipline than those who are less energetic. Also, the hyper-irritable individual is more likely to resent discipline and criticism.

Aggressiveness is in direct relationship to the individual's ability to be aggressive. Aggression is a normal attribute of the human being and is a part of his instinctive make-up. The physically well-endowed, energetic, reactive individual, with not too much affect, will prove the most aggressive, whereas the person who is continually thinking of the feelings of others, who does not like to hurt other people, who is easily hurt himself because of sensitiveness or hyper-irritability, who is not too well endowed with energy, will not show aggressive characteristics.

What are the factors in producing honesty? Again, honesty is the result of the courage to be honest; and dishonesty will be found in the nervous type individual, the individual who is fearful, afraid of his ability to maintain his convictions or to do the hard work necessary to an honest effort.

It becomes apparent that for the good sailor under combat conditions, physical fitness, good energy, drive, determination, not above average excitability, not above average affective capacity, somewhat better than average curiosity and alertness, and intelligence of the high school level are desirable in anybody who expects to rise above the seaman first class level, with the highly technical problems confronting him. For the hospital corpsman, he must be an individual who is sufficiently excitable and reactive to feel situations and move quickly in them, but one who is not going to react with too intense feelings. He must have adequate energy, but it need not be of the highly aggressive variety; rather it should be a type that can be expended in somewhat smaller amounts over a prolonged period. He is never called on for sudden, intense effort, but must keep up a persistent effort over long periods. He must have better than average affective capacity or he will not have the necessary interest in the patients under his care. He must be above average in mental activity or he will not be able to learn the many and various technics necessary to a hospital corpsman, or to devise ways of meeting situations when short of the necessary materials. He cannot master the knowledge necessary without at least a high school level of intelligence.

Let us now examine some of the failures in the light of the necessary qualities to make for success:

ANALYSIS OF SOME OF THE FAILURES FOR SUCCESS

CORPSMEN

1. (a) Low irritability, slow, phlegmatic.
   (b) Low intelligence—10 years.
2. (a) Low intelligence—10 years.

3. (a) High irritability.
  (b) High affect—immature, poorly developed, fear of evil, repressed and inhibited.
  (c) Cyclothymic—periods of depression and periods of increased activity.
4. (a) High irritability. Poor reflex and instinctive control.
  (b) Low affect.
  (c) High intelligence.
5. (a) Exceptional physical development.
  (b) Hyperirritable. Strong instinctive drives.
  (c) Excessive energy and drive.
  (d) High affect.
  (e) High intelligence.
  (f) Capacities poorly integrated and poorly controlled.
6. (a) Poor physical development.
  (b) High irritability. Seasickness.
  (c) High affect but immature and repressed.
  (d) Low intelligence.
7. (a) Poor physical development. Bad acne.
  (b) High irritability, anxious, sensitive, enuresis, fainting.
  (c) Low energy or drive.
  (d) High affect but poorly developed with withdrawn behavior.
8. (a) Poor physical development.
  (b) Hyperirritable.
  (c) Low energy or drive.
  (d) High affect but immature, dependent, insecure.
9. (a) High energy.
  (b) Affect poorly developed.
  (c) Low intelligence.
10. (a) Hyperirritability.
  (b) Low intelligence—10 years.

PRISONERS

1. (a) Strong instinctual drives, aggressive, hostile.
  (b) Low affect.
  (c) Average intelligence.
2. (a) Poorly controlled reflex and instinctive behavior. Enuresis up to 15.
  (b) Low energy.
  (c) Dependent on mother.
  (d) Low intelligence.
3. (a) Poor physical development.
  (b) High irritability, autonomic instability, angio-edema.
  (c) Low energy.
  (d) High intelligence.
4. (a) Hyperirritability. Has enuresis. Anxiety, tension. Poor instinctual control.
  (b) High affect—dependent, insecure, immature.
  (c) Low mental activity.
5. (a) Poor reflex control. Enuresis up to 10 years.
  (b) Low affect—inability to make relationships or be guided by them.
6. (a) Schizoid make-up, withdrawn, fantasy, preoccupied.
  (b) Low intelligence.
7. (a) High irritability—enuresis up to 10 years, anxiety, tension.
  (b) Low energy and drive.

    (*c*) High affect but dependent and immature.
8. (*a*) Poor physical development.
    (*b*) Poor energy or drive.
    (*c*) Affect poorly developed, immature, dependent.
    (*d*) Mental activity—no reasoning or judgment.
    (*e*) Preschizophrenic.
9. (*a*) High irritability.
    (*b*) High affect—poorly developed, immature.
    (*c*) Low intelligence.
10. (*a*) High irritability.
    (*b*) High affect.
    (*c*) Low intelligence.

CONCLUSIONS

1. All psychiatric examinations of recruits should be made at the training stations. At the recruiting stations only the obviously incompetent can be weeded out, and examination is not necessary.

2. At the training station there should be an increased time for psychiatric examination, so that certain definite questions concerning the individual's behavior in relationship to his previous environment, his attitudes toward his family, his social activities, athletics and school work can be asked, and an initial estimate of his capacities and present temperamental status can be made, noted, and sent to his company commander.

3. If the time at the training station is to be reduced, then the larger part of the training must take place after the recruit is sent to duty, so that the major emphasis at the training station should be on getting to know the man and his capacities in order that a wise selection can be made.

4. The company commander should immediately start checking on the observations made by the psychiatrist at the time of induction and should be aided in setting up test situations to demonstrate physical ability, excitability, energy and drive. Every week he should check on his observations and, at the end of the training period, make definite recommendations for the type of duty to which that recruit is to be sent. This should be detailed as to the kind of ship, whether submarine, destroyer, cruiser, or battleship; whether the recruit is fit for combat conditions on the ship or should be at sea in a situation where emergencies are unlikely to arise; whether the recruit would do better in some type of shore duty.

5. The company commander, at the end of the training period, should meet with the psychiatrist and they together should make the final selection for the type of duty.

6. In order that no human material shall be wasted, there should be formed labor battalions and work details connected with hospitals where closer observation is possible, where men of doubtful capacities

can be sent for further training and observation, with the idea that ultimately they will be able to undertake more active duty.

7. A system should be worked out so that duties can be shifted and, where a man is found unfit for destroyer duty or some other special duty, he will not have to be surveyed from the Navy, but can be transferred, at least temporarily, to some other duty for which he is more capable.

8. It should also be possible, where men are showing signs of nervous exhaustion either through anxiety, apathy, or through various somatic symptoms, that they can be sent ashore for periods of three weeks or a month and then again returned to duty.

HEMORRHAGE AND HEMORRHAGIC DIATHESES

By Lieutenant, junior grade, Eugene L. Lozner, Medical Corps, United States Naval Reserve

The body, when injured, possesses two main defenses against the occurrence of hemorrhage (1) (2). For want of better terms, these may be called the blood coagulability defense and the vascular defense. When either of these fails, hemorrhage is apt to occur.

The blood coagulability defense depends upon the phenomenon of the coagulation of blood when it is shed. There still remains considerable controversy as to the exact mechanism of this reaction but it is believed that at least four constituents of the plasma, namely, prothrombin, calcium, thromboplastin and fibrinogen, take part. The first three of these are thought to interreact to form thrombin, a factor capable of converting fibrinogen from its sol or soluble form to its gel or insoluble form, fibrin (3). It is important to bear in mind that prothrombin, thromboplastin, and thrombin are not at present known chemical entities but are defined chiefly by their physiological activities. They might, therefore, be termed physiological complexes rather than materials. The origin of the complex thromboplastin is a particularly disputed point. This perhaps results from the fact that this complex is defined by the ability to promote the clotting of blood. Such ability can be isolated from parenchymatous tissues, brain, lung, etc. (4), from the formed elements of the blood (5), and from the cell-free plasma itself (6). That this clot-promoting ability derives from the same chemical substance in each instance is, however, not at all clear.

The vascular defense depends upon several well-known reactions of blood vessels to injury. In the first place, there is the normal resistance of blood vessels to trauma and to changes in intravascular pressure. This is commonly termed capillary resistance, or fragility, and in fact governs the ease of bruising of the individual. A second

factor in this defense is the ability of cut ends of blood vessels to constrict and retract when the vessel is severed. This phenomenon is known to every surgeon who following an incision may observe several "spurters" and in the time it takes to apply a hemostat, notes that these vessels have constricted and "disappeared" beneath the edges of the wound. It is in connection with vascular defense that platelets apparently have their chief function. Their number may usually be positively correlated with capillary fragility for reasons yet unknown. And when a blood vessel is cut, the platelets mobilize to the site of the wound and there clump together and cause the retraction of fibrin which has been formed by the blood coagulation reaction. The number of platelets in the blood significantly affects the retraction of the clot when coagulation occurs. This is shown in the experiment illustrated in figure I in which the number of platelets of a specimen of normal human citrated plasma was varied by filtration and the plasma then recalcified, causing coagulation.

A classification of the group of conditions commonly called "hemorrhagic diatheses" may be attempted with respect to whether there exists failure of blood coagulability defense (7) or of vascular defense (8). It must be emphasized that this classification, like any other applied to a field in which much is unknown, should not be considered a rigid one. Rather, it is offered in the spirit of possible usefulness to the clinician who, upon being confronted with a hemorrhagic disease problem, desires to approach it rationally and systematically.

List I presents those conditions in which blood coagulability defense has failed. Quick (7) has recently reviewed this group. It will be observed that such failure can result from either a deficiency of one of the factors concerned with blood coagulation or from the presence of a circulating anticoagulant. The existence of a hemorrhagic diathesis, consequent upon a deficiency of calcium, is extremely doubtful since it has been shown experimentally that a calcium concentration sufficiently low to interfere with blood coagulation is far below that which is compatible with life (9).

LIST I.—HEMORRHAGIC DIATHESES RESULTING FROM FAILURE OF BLOOD
COAGULABILITY DEFENSE

A. THOSE DUE TO DEFICIENCY OF BLOOD COAGULATION FACTOR
    I. PROTHROMBIN (HYPOPROTHROMBINEMIA) :
        (a) Nutritional deficiency of vitamin K.
            1. Dietary deficiency of vitamin K.
            2. Failure of production of vitamin K by intestinal flora.
            3. Failure of absorption of vitamin K.
                (a) Exclusion of bile from intestinal tract.
                (b) Intestinal disease.
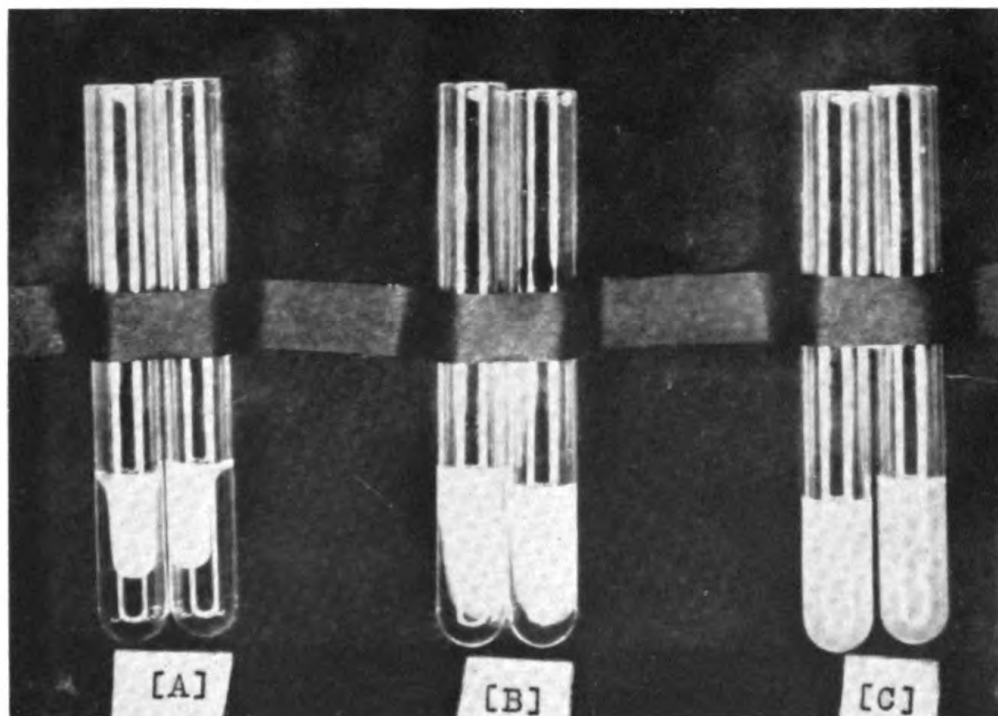
FIGURE 1.—THE RELATIONSHIP OF THE PLATELET CONTENT OF NORMAL HUMAN CITRATED PLASMA TO THE AMOUNT OF CLOT RETRACTION AFTER RECALCIFICATION.

Each of the six tubes contains 2 ml. normal human citrated plasma to which 0.4 ml. of 0.5% calcium chloride solution has been added. The photographs were taken one hour after recalcification.

Tubes (A) contain unfiltered plasma with a platelet count of 142,000 per cu. mm.

Tubes (B) contain the same plasma after filtration through #42 Whatman paper. Platelet count was 47,000 per cu. mm.

Tubes (C) contain the same plasma after filtration through a Berkefeld V filter. Platelet count was 6,000 per cu. mm.

A. THOSE DUE TO DEFICIENCY OF BLOOD COAGULATION FACTOR—continued.

    I. PROTHROMBIN (HYPOPROTHROMBINEMIA)—continued

        (b) Failure of production of prothrombin due to liver disease.

        (c) Increased utilization, destruction, and excretion.

            1. Hyperpyrexia.

            2. Major surgical operations.

            3. Wangensteen drainage.

    II. CALCIUM (Hemophilia calcipriva, nonexistent).

    III. THROMBOPLASTIN (Hemophilia).

    IV. FIBRINOGEN (FIBRINOPENIA).

        (a) Congenital.

        (b) Acquired—liver disease.

B. THOSE DUE TO PRESENCE OF A CIRCULATING ANTICOAGULANT.

    I. HEPARIN.

        (a) Anaphylactic and peptone shock.

    II. UNKNOWN.

List II presents those conditions in which vascular defense has failed. Madison and Squier (8) have reviewed this group. It will be observed that such failure can result from either organic or functional disturbance of the peripheral vascular system. Within the functional group are included those conditions associated with thrombocytopenia and therefore it is convenient to divide this group into thrombocytopenic and nonthrombocytopenic varieties. In the latter falls the nutritional deficiency, scurvy.

LIST II.—HEMORRHAGIC DIATHESES RESULTING FROM FAILURE OF
VASCULAR DEFENSE

A. ORGANIC DISEASE OF PERIPHERAL VASCULAR SYSTEM.

    I. ARTERIOSCLEROSIS (SENILE PURPURA).

    II. TELANGIECTASIA.

    III. VARICOSE VEINS.

B. FUNCTIONAL DISEASE OF PERIPHERAL VASCULAR SYSTEM.

    I. WITHOUT DECREASE IN PLATELETS (NONTHROMBOCYTOPENIC).

        (a) Toxic purpura.

        (b) Allergic purpura (purpura simplex, Schönlein's, Henoch's).

        (c) Nutritional (Scurvy).

        (d) Idiopathic (Thrombasthenia).

    II. WITH DECREASE IN PLATELETS (THROMBOCYTOPENIC).

        (a) Toxic purpura.

        (b) Allergic purpura.

        (c) Symptomatic purpura (Thrombocytopenia secondary to generalized disease of bone marrow).

            1. Leukemia.

            2. Aplastic anemia.

            3. Pernicious anemia.

            4. Hypochromic anemia associated with chronic blood loss.

            5. Chronic hemolytic anemia.

            6. Carcinomatosis, lymphomatosis, miliary tbc., etc.

        (d) Idiopathic thrombocytopenic purpura.

The differential diagnosis of the hemorrhagic diatheses is dependent, first of all, on the taking of an adequate history and performance of a complete physical examination and the routine laboratory tests. It is usually impossible, however, to arrive at an unequivocal diagnosis without the performance of certain additional laboratory tests. These are the bleeding time (10), tourniquet test (11), venous clotting (12), clot retraction (13), platelet count (14), and prothrombin time (4). In table I is presented a summary of experience with these tests. The bold horizontal line through the center of the chart divides those conditions in which vascular defense has failed from those in which blood coagulability defense has failed. It will be observed that in the former group it is chiefly the bleeding time and tourniquet test which is abnormal and, in addition, when there is thrombocytopenia, it will be indicated by the low platelet count and by the diminished-to-absent clot retraction. The venous clotting time and prothrombin time are invariably normal in this group. On the other hand, in the group in which blood coagulability defense has failed, the bleeding time, tourniquet

TABLE I.—*The use of certain laboratory tests in the differential diagnosis of the hemorrhagic diatheses*

Diagnosis	Laboratory tests						
	Bleeding time (minutes) Normal values: ½-2	Tourniquet test (petechiae) 0-10	Venous clotting time (minutes) 6-12	Clot retraction (0-++++) +++-++++	Platelet count (thousands/ mm³) 250-400	Prothrombin time (seconds) 22-25	Miscellaneous
Organic peripheral vascular disease.	¹ *2-4*-10	¹ *10-20-50*	6-12	+++-++++	250-400	22-25	
Functional peripheral vascular disease: Non-thrombocytopenic — (toxic, allergic, idiopathic).	¹ 2-*4-10*	¹ *10-20-50*	6-12	+++-++++	250-400	22-25	
Functional peripheral vascular disease: Non-thrombocytopenic — (nutritional, (scurvy)).	¹ 2-*4-10*	¹ *10-20-50*	6-12	+++-++++	250-400	22-25	Low plasma vitamin C.
Functional peripheral vascular disease: Thrombocytopenic— (toxic, allergic, idiopathic).	¹ 2-*4-10*	¹*20-50-100*	6-12	0-++	¹*0-50*-100	22-25	
Functional peripheral vascular disease: Thrombocytopenic— (symptomatic).	¹ 2-*4-10*	¹*20-50*-100	6-12	0-++	¹0-*50-100*	22-25	Leukemia, leukopenia, anemia, miliary tbc., etc.
Hypoprothrombinemia.	½-2	0-10	¹ *6-12*-30	+++-++++	250-400	¹*28-40*-100	Usually responds to vitamin K.
Hemophilia..............	½-2	0-10	¹*30-60-240*	+++-++++	250-400	22-25	Hereditary — males.
Fibrinopenia............	¹ ½-*2-4*	0-10	¹ *20-30-60*	+++-++++	250-400	¹*28-40*-100	Low plasma fibrinogen.
Anticoagulant in blood.	*½*-2	0-10	¹ *30-60*-90	+++-++++	250-400	¹*28-40*-100	Anticoagulant in blood.

¹ Where 3 values are given, the range most frequently encountered is in italics.

test, platelet count and clot retraction are all invariably normal, while the venous clotting time and prothrombin time are frequently prolonged. It is of utmost importance that the clotting time be done on venous blood obtained with a nontraumatic venipuncture. Clotting times on capillary blood are almost valueless because of the inclusion of thromboplastic tissue juice and even in a hemophiliac such a clotting time may be normal.

Space here does not permit entering into the details of the clinical pictures and treatment of each of the hemorrhagic diatheses. If the cause is known, such as poisoning by a drug, this cause must be eliminated. By and large, the most valuable single non-specific therapeutic measure has been the transfusion of relatively fresh citrated whole blood or plasma. Frequently this is the only therapy available. In the treatment of external hemorrhage, rabbit thrombin has recently been shown to be a useful local hemostatic (15). The therapy of hemophilia is still far from satisfactory (16). Several monographs have recently been written on vitamin K therapy (17) (18). In idiopathic thrombocytopenic purpura, splenectomy is very often dramatically effective (19). However, before splenectomy is undertaken, the diagnosis of symptomatic thrombocytopenic purpura must be rigidly excluded, as in certain patients of this group removal of the spleen may be distinctly harmful.

SUMMARY

1. The defenses of the body against hemorrhage have been outlined.

2. A suggested classification of the hemorrhagic diatheses, based on these defenses, is presented.

3. The differential diagnosis of the hemorrhagic diatheses is discussed.

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CONSTITUTIONAL PSYCHOPATHIC STATE AS RELATED TO THE NAVY

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Psychiatric disorders obviously are incompatible with the naval service. A large majority of them such as schizophrenia, manic-depressive psychosis, and paresis are easily recognized and thus rejected before induction into the service, or at least during the initial recruit training period. Important as these major disorders are, it is not they that we are concerned with at this time. It is rather to that heterogenous group of abnormalities known as constitutional psychopathic states that we would draw your attention.

Constitutional psychopathic state is the term most widely used in referring to this disorder (1); however, at various times it has been

called psychopathic personality, psychasthenia or a form of psychoneurosis. In this group are found juvenile delinquents, recidivist criminals, paupers, prostitutes, sexual perverts, ne'er-do-wells, family black sheep, so-called crazy geniuses, and various other types of individuals who are consistently at odds with constituted authority. People of this type are usually not considered psychotic; however, many of them are potential psychotics. They usually escape the attention of psychiatrists and are sheltered and extracted from difficult situations by friends and relatives. When placed in a new environment (such as the Navy), more or less on their own, their behavior becomes most difficult and often constitutes a distinct burden upon society or the naval service as the case may be.

The tendency in the past has been to group all sorts of vague, obscure, borderline cases under this heading, using it more or less as a psychiatric waste basket or "catch-all." Recently, however, a definite subclassification of this entity has been developed (2). It is as follows:

CONSTITUTIONAL PSYCHOPATHIC STATE

1. Inferiority without psychosis.
2. Emotional instability.
3. Criminalism.
4. Inadequate personality.
5. Paranoid personality.
6. Pathological liar.
7. Sexual psychopathy.

Most of the cases can be fitted into one of the above classifications. As can be seen, the majority are characterized by an emotional abnormality, although certain of the inferiority group are obviously lacking in intellect.

According to Wechsler, constitutional psychopathic state is classed as a form of psychoneurosis in the general classification of mental disease. Equally eminent psychiatrists may differ on this point; however, it is more of academic than practical interest. Régis aptly described constitutional psychopathic state when he said that it was "one long contradiction between the apparent wealth of means and poverty of results." Much has been written concerning the etiology of this condition, but little is known as to its true cause.

The five main etiological theories that have been advanced are as follows (3):

1. Pathologic—due to biochemical alteration of the nervous tissue.
2. Physiologic—due to excess stimulation or inhibition of the nervous system.
3. Endocrine—due to glandular dysfunction.
4. Suggestive—due to overreadiness to accept an idea or suggestion as the truth no matter how queer or abnormal.

5. Psychoanalytic—due to arrest of psycho-sexual development at an infantile stage.

Interesting as these theories are, the only concrete statement that can be made is that heredity (environment to a lesser degree) plays the most important role. In the words of Van Geson, "The potential energies of the higher constellations of their association centers have been squandered by their ancestors." In other words not all of us start life with the same amount of nerve capital (4).

As far as the Navy is concerned, a constitutional psychopathic state is a distinct and vital problem. Since this type of person has so much difficulty in his home community, he all too often attempts to join the Navy as a means to escape from an unpleasant environment, or is prodded into doing so by relatives or local authorities who have tired of attempts at rehabilitation. Fortunately this latter practice is not as common as it formerly was. In order to realize why the Navy should be concerned with this matter, one has only to peruse the list of surveys from the service during 1940. During the quarter ending December 1940, 40 cases of constitutional psychopathic state were surveyed from the Navy (5), to say nothing of 17 cases of psychoneurosis. Looking at the problem from a monetary angle, the United States Government during the year of 1940 paid out $41,889,360.00 for the care of veterans suffering from mental and nervous diseases (6). A large number of these fall into the category we are considering.

All too often a man in good physical condition with no apparent mental abnormalities passes the entrance examination, manages to slide through the preliminary training period (9), and subsequently is sent to one of the ships. The manifestations of this disorder being protean, his future course may fall into one of any number of categories. Ordinarily he is slow to acclimate himself to military life aboard ship. He is stubborn, indifferent, resentful, and loathe to carry out orders without first offering some argument or excuse. If he leans to paranoia, he complains that his associates and superior officers have it in for him and are working against him. More often than not he shirks his work and tries to do as little as possible. Often times he can be found reading cheap literature in some out of the way corner when he should be shining bright work. He is constantly being brought before the mast for minor infractions of the rules. The medical officer has an excellent chance to pick out these cases in that they invariably are frequent visitors at the sick bay, malingering illness in an endeavor to obtain special favors or to avoid work. So far we have considered only the minor manifestations that occur. All too often this disorder gives rise to more serious offenses which tend to disrupt the ship's routine. Into this

class falls the sexual offender who oftentimes is a case of constitutional psychopathic state. As long as he gets away with his particular type of perversion, he constitutes an undermining factor to the ship's morale. Sooner or later he is apprehended and brought to trial with the result that a number of important officers must drop their regular duties and put in time and effort on his case. The whole episode produces an unhealthy and repulsive atmosphere aboard ship which could and should be avoided.

On the other hand our man may have criminal tendencies and indulge in petty thievery, another practice which cannot be tolerated and requires time consuming action. Oftentimes this type of man indulges in alcohol to excess, thus frequently being at odds with local civilian authorities. This type of thing reflects discredit upon the entire naval service. A man of this group is frequently the recipient of a venereal disease, since he possesses neither the restraint nor the cleanliness of habits to avoid it. In cases like this, the Navy is obliged to give him medical aid with the resultant cost and loss of working days.

One could go on citing characteristics of constitutional psychopathic state ad infinitum, but the scope of this paper does not permit.

As far as treatment is concerned, it is theoretically possible to reeducate those suffering from intellectual lack to a degree commensurate with their capacity to learn. The emotional type tends to spontaneous improvement after the fourth decade due to slowing down of emotional drive. Before this time very little can be done to help these men. It is said that psychoanalysis is of benefit in selected cases; however, such a procedure is time consuming and impracticable in the Navy. As unaltruistic as it may seem, the Navy is not particularly interested in treatment of these cases, although it is sometimes foisted upon it. The Navy Medical Corps is concerned more with keeping these men out of the service than treating them after they are in. "Keeping as many men at as many guns as many days as possible" can be best accomplished if there are no cases of constitutional psychopathic state sprinkled among the personnel.

The crux of the situation resolves itself into one fact. Men suffering from this disorder should be prevented from joining the Navy. This can best be accomplished by including a careful psychiatric examination at the time of enlistment (8). This examination, best done by a trained psychiatrist, should include a careful past personal and family history. If possible, arrangements should be made for a conference with a relative or responsible adult who has known the candidate since childhood. One should regard with suspicion any history which reveals temper tantrums, excess emotionalism,

stealing, inability to get along in school, repeated conflict with local authorities, and constant shifting from one job to another. If the man passes his initial examination, a close psychiatric check should be kept on him during his recruit training period in order to weed out those showing abnormal symptoms due to their sudden change in environment.

The Selective Service, at the advice of the surgeons general and various prominent psychiatrists, has appointed a neuropsychiatric committee to formulate plans for a careful mental examination of all selectees. In order to have a concrete plan to work on, it seems propitious to list the 11-point plan as recommended by Dr. Franklin G. Ebaugh (7), professor of psychiatry at the University of Colorado and also a member of the selective service neuropsychiatric committee. He recommends the following program:

1. Every recruiting officer should have knowledge of personality disorders and be encouraged to use this knowledge.

2. All recruits should be subjected to a period of probational training of 3 to 6 months in order that misfits, neurotics, psychopaths, and psychotics can be eliminated.

3. A department should be developed to form a. liaison between school and community agencies so that the educational, social and health records of the recruit can be made more easily available in evaluating the men before induction.

4. Armed services should, as far as it is feasible and possible, avail themselves of the experiences and technics of industry in choosing personnel.

5. The public should be instructed in mental health through a wider propagation of the fact than now prevails.

6. Rehabilitation and vocational guidance services should be set up to reestablish disabled and discharged service men in society in a useful way.

7. Agencies should be established to advise and assist rejectees in making better civilian adjustments and obtaining medical and psychiatric treatment.

8. Such terms as "shell shock," disordered action of the heart, neurocirculatory asthenia and all others that implicate a part of the body diseased when it is only participating in a personality reaction should be eliminated from medical and psychiatric terminology.

9. In combat the psychotic individual should be immediately evacuated and sent to an appropriate hospital for treatment. The psychoneurotic and psychopathic patient should, if possible, receive intensive treatment in the zone of combat and returned to duty as soon as possible.

10. Psychiatrists should be stationed on hospital ships, on larger warships, and in hospitals near the zone of action.

11. More or less permanent organizations should be developed to formulate means of improving case records, to evaluate clinical data, to direct research and to integrate this data with new medico-psychiatric movements and projects that are of particular importance to military and civil mental health and to industrial and vocational psychiatry.

Certain minor alterations have been made in this outline in order to render it more applicable to the Naval Service.

I believe that if these points would be kept in mind a substantial decrease could be made in the number of constitutional psychopathic states gaining entrance into the service; and thus the Navy would be better able to fulfill its mission of teaching healthy, mentally normal men to man its ships.

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AN ACUTE RESPIRATORY INFECTION RESEMBLING SO-CALLED ACUTE PNEUMONITIS

A REPORT OF 40 CASES

By Lieutenant Commander LeRoy B. Duggan, Medical Corps, United States Naval Reserve, and Lieutenant William L. Powers, Medical Corps, United States Naval Reserve

During the months of June, July, and August of 1941, the department of medicine at the United States Naval Hospital, Corpus Christi, Tex., observed an acute infectious disease of the respiratory tract with unusual pathological changes in the lung. ·

There were 112 admissions with acute respiratory infections during this period and the present study is based on 40 cases with the above unusual lung findings. These patients were young adult members of the United States naval military service and were between the ages of 17 and 26 years.

Cases which apparently simulate these have been reported during the past several years in the United States and foreign countries, e. g., England, France, Hawaii, and Spain.

The disease differs from the familiar forms of lobar pneumonia caused by pneumococci and from the usual types of bronchopneu-

monia caused by hemolytic streptococci, staphylococci and other organisms. In the majority of the cases reported the course of the infection is characterized by an insidious onset with minimal respiratory and mild constitutional symptoms. At the onset there are no definite abnormal physical signs and the leukocyte count is normal or only slightly elevated. Within 48 hours a roentgenogram of the chest shows a small area of pulmonary consolidation usually located at the base of one lung.

This disease has been described by a variety of names, e. g., as acute influenzal pneumonitis (3), acute pneumonitis (1), atypical pneumonia (5), acute interstitial pneumonitis, atypical bronchopneumonia (11), peribronchial pneumonitis (9), and adolescent pneumonia (6).

In 1934 Gallagher reported a series of 16 cases with what he termed adolescent pneumonia and which had many characteristics very similar to this clinical picture. Bowen, however, was apparently the first to suggest that this infection might be a new disease entity when, in 1935, he described an outbreak occurring among Army troops stationed in Hawaii. In 1936, Allen, at Fort Sam Houston, Tex., reported a series of 50 cases with acute pneumonitis. In 1937, Scadding, in England, reported a group which he called disseminated focal pneumonia. In 1938, 1939, and 1940, sporadic cases and minor epidemics were reported in the United States and England. These outbreaks were widely scattered in this country, with isolated cases and minor epidemics being reported in Pennsylvania, Oregon, Texas, New York, Minnesota, Ohio, Delaware, Maryland, California, and Massachusetts. In 1941 small epidemics have already been reported from widely separated points in Texas and Oklahoma.

The majority of these reports describe cases very similar to those we have observed in our series. However, those described independently by Cass in 1936 and Reimann in 1938 had more marked constitutional symptoms than those we have seen. Also the series reported by Reimann and Haven in 1939 differed in that those cases associated with abnormal pulmonary changes had severe constitutional symptoms and those having mild symptoms similar to our cases had inflammatory changes in the upper respiratory tract. Symptoms due primarily to inflammation in the upper respiratory tract were not an important or frequent finding in our cases or in the majority of those reported by other workers.

At the present time there is considerable speculation as to whether these cases represent a separate disease entity caused by some type of filtrable virus or are simply atypical bronchopneumonias caused by one of the usual types of bacterial organisms. Since these cases

occur largely in previously healthy young adults, Lyght and Cole have questioned not only that this infection is typical for this age group and type of individual, but also that it is a new or separate disease entity. They call attention to the fact that the concept of pneumonia, as a disease entity, can no longer be restricted to a well defined clinical picture because both the nature and severity of the infection are subject to too many variables. It was their opinion that the concept of pneumonia should be broadened to include the type of case under discussion.

Although the etiology of this disease is still in doubt, the prevailing opinion seems to be that it is caused by some type of filtrable virus. There is some evidence to support this view as shown by the following, e. g.:

1. The contagiousness of the disease.

2. The inability to demonstrate reactions associated with any known pathogenic bacteria either by culture of the sputum and blood or by other laboratory procedures.

3. Failure of the infection to respond favorably to sulfonamide chemotherapy.

4. Work of Horsfall and Weir and Stokes and Francis with recovery of a virus and production of pulmonary consolidation in animals.

Stokes and Francis obtained an unusual virus from the nasopharyngeal washings of one of Reimann's patients and from the blood of another. It was virulent for mice and caused pneumonia and encephalitis about 2 weeks after inoculation. However, they were unable to do serological tests because of the loss of the agent and, therefore, were unable to establish a causative relationship.

Although Horsfall and Weir were not able to infect a variety of animals by intranasal inoculation with throat washings from a number of clinically typical cases, they were successful in transmitting the infection to the wild mongoose. They succeeded in recovering a virus which on inoculation produced pulmonary consolidation in the animal. Healthy mongooses placed in contact with infected mongooses developed pulmonary consolidation. The virus was neutralized by the serum of mongooses convalescent from the infection but was not neutralized by normal mongoose serum. Serum of human beings convalescent from acute pneumonitis also neutralized the virus, but serum obtained from the same persons during the acute phase of the disease failed to do so. The virus was filtrable through Berkefeld V. and N. Candles, was not inactivated by glycerin or freezing and drying in vacuum, and was propagated for at least 30 serial passages on the chorio-allantoic membrane of the developing chick embryo. It was the opinion of the authors that virus is the cause of so-called acute pneumonitis in human beings.

Enders, Sullivan, Hammon, and Meakins of the Department of Bacteriology, Harvard Medical School, attempted to demonstrate an

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etiologic agent by the inoculation of mice, rabbits, guinea pigs, ferrets and macao mulatta with blood, sputum, and nasopharyngeal washings from 11 patients in Murray's series of cases, but were unable to produce any recognizable pathologic changes in any of the animals.

The pathology of this disease is limited to the findings in one fatal case which occurred in Kneeland and Smetanas series at the Presbyterian Hospital, New York City. The microscopic features of the pneumonia were characterized by a mononuclear cell exudate in the pulmonary alveoli and an acute pulmonary vasculitis. However, none of our cases are comparable to their group of severe infections in which the death occurred, and therefore, any conclusions drawn regarding similar pathologic changes in our series of cases are likely not to be accurate.

Most of the reports of this disease have been made as a result of the study of outbreaks occurring among young adults living either in colleges or quartered with military troop concentrations. In these two groups a substantial number of cases have occurred over relatively short periods of time, and therefore, the disease has been thought to be readily transmissible. Although our report represents a similar situation we were unable to find that disease was any more prevalent among the men living in barracks with possible contacts than in those who were unexposed.

The disease occurred in about the same ratio in aviation cadets, was of about the same severity, and ran a similar clinical course. Enlisted men living at outlying auxiliary fields acquired the infection, but these cases were rare. Although we were unable to trace exposure or contacts of sufficient number to determine the definite degree of contagiousness, it was our opinion that it was probably transmitted from one person to another by casual contact.

There was no evidence to indicate that lack of physical fitness, previous upper respiratory infections, abnormal exposure, physical fatigue and climatic conditions were predisposing factors.

CLINICAL DATA

The average typical case began as a simple acute infection with minimal respiratory symptoms. Usually, for a day or two preceding admission, the patient had not felt well. Following this, he developed a moderately severe frontal headache, backache, pains in legs, weakness, unproductive cough and, fever (100°–102°). In the large majority of instances, these patients were considered only moderately ill.

On admission, physical signs were minimal or entirely absent. Usually there was slight redness and injection of the pharynx, and

an elevated temperature. The pulse was either normal, or the pulse-temperature ratio showed a relative bradycardia. The respiratory rate was normal. There were no abnormal physical signs on examination of the chest. The leukocyte count was normal or slightly elevated with the percentage of polymorphonuclear cells either normal or slightly increased.

The diagnosis was usually made on the third to fifth day when roentgenogram of the chest was made and a small abnormal area of moderate density was found in one lung field. A day or two later crepitant rales could be heard at the base of one lung, posteriorly. Usually, there were no physical signs indicating pulmonary consolidation. The cough continued and by then the patient had begun to expectorate a small amount of mucopurulent sputum. The temperature returned to normal in about 6 to 8 days. Defervescence was by slow lysis. By this time medium moist rales could be heard at the base of one lung and usually persisted for 7 to 10 days. The patient remained in the hospital another week or two and was returned to duty, well.

ANALYSIS OF SIGNS AND SYMPTOMS

Approximately one-fourth of our cases had a relatively sudden onset, under 24 hours. Only one-sixth had a previous history of an upper respiratory infection, such as colds and sore throats, during the 3 weeks preceding the onset. Approximately one-third had typical nasal symptoms of an acute rhinitis at the onset of the infection; one-fourth had a mild sore throat. Only two patients had an actual chill and only three complained of a chilly sensation. One-fourth complained of substernal discomfort which was usually a burning sensation, although a few complained of substernal tightness. There was no actual chest pain characteristic of pleurisy; no dyspnea or the expectoration of bloody sputum.

The physical examination at the onset was characterized by its lack of abnormal findings. In approximately three-fourths of the cases the chest was normal. In eight cases there were crepitant rales at the bases of the lungs, but most of these reported to the sick bay after having been sick for a few days. In a few cases sibilant rales were present and in about the same number sibilant and crepitant rales were both heard. These were usually located at the base of the lungs, posteriorly. Diminished breath sounds were present in a few cases and dullness on percussion in only one. There were no definite physical signs of pulmonary consolidation in any case at the onset of the infection.

The temperature curve varied moderately during the course of the disease. In the majority of the cases the temperature would rise

to 101°–102° at the onset, remain elevated for 4 to 8 days dropping gradually to normal. In about one-sixth of the cases the temperature was elevated to 103°–104° for several days. These patients were definitely sicker than the others as manifested by associated clinical evidence. In five cases there was a low grade fever under 100° which ran from 12 to 23 days. The pulse temperature ratio was either normal or a relative bradycardia was present.

During the course of the illness the two most significant factors were the paucity of chest findings on physical examination and the persistence of rales once they appeared. In five cases rales were heard before the third day, but in these we were doubtful as to whether the history of the day of onset was accurate. In the large majority of cases rales were heard first from the fourth to the eighth day of the illness. In one-fourth of the cases no abnormal chest signs were ever apparent and in four cases rales were not heard until the ninth to the eleventh day. The rales were usually medium, moist in type and usually persisted from 1 to 2 weeks.

In the large majority of cases the sputum was usually absent or very scanty for the first 4 or 5 days, and after that the patient expectorated small amounts of muco-purulent material for a few days.

Approximately one-half the patients were in the hospital for 3 weeks and the majority of the remaining were in about 2 weeks. A few cases were sent to duty in 8 to 10 days; these were very mild cases. In the majority of cases hospitalization was prolonged by the weakness of the patient, a persistent cough or rales after all other symptoms and signs had subsided. The complete recovery of the patient was essential in our cases because of the necessity that he be fit for any and all military duty before being allowed to leave the hospital.

There were no serious complications in any of our cases and no fatalities.

ROENTGENOLOGICAL DATA

The outstanding observation concerning the roentgenographic findings was the fact that changes within the lung were present for several days before they could be determined by physical examination of the chest. Three of our cases had roentgenograms as early as the second day, and changes were found in all of these. In Murray's series of cases, changes were found within 24 hours after the initial symptoms.

The roentgenograms usually showed a small irregular or rounded area of soft to moderate homogeneous density in the central portion with borders shading into normal lung. In many of the cases the

density was very thin although of an even quality. This was particularly true of those lesions appearing in the costophrenic angle. As a whole the lesions were not extensive, particularly those extending from the lower border of the hilus and those found in the costophrenic angle. It was our opinion that some of the lesions extending below and outside the left border of the heart would have been shown to be more extensive could we have obtained lateral roentgenograms of the chest. The distribution of the lesion was lobular rather than lobar and the majority showed only a small section of one lobe to be involved. In a few cases the lesion was more extensive, but these were the exception rather than the rule. Multiple, successive roentgenograms in several cases demonstrated that as the disease progresses the density increases, became more sharply defined and frequently increased in size. Also, resolution was shown to follow the course of other types of pneumonia, the density gradually diminishing and becoming more mottled and linear in type.

In the majority of cases, approximately three-fourths, the lesion either extended from the lower border of the hilus region into the cardiophrenic angle, or appeared either in the costophrenic angle or at the base of the lower lobe of the lung. Sixteen cases had lesions at the left base, 7 at the right base, and 5 at both bases. Seven cases extended from the hilus toward the mid-portion of the lung. In 4 cases the lesion occurred in the upper lobe, and in 2 cases there were lesions in both upper lobes. In 1 case, lesions were located in the right upper and lower left lobe.

<center>LABORATORY DATA</center>

The average case showed a normal or slightly elevated initial leukocyte count and a normal to slightly elevated percentage of polymorphonuclear cells. Only 2 leukocyte counts were below 6,000 and the majority ranged between 6,000 to 9,000; 6 counts were above 10,000, but a few of these were obtained late in the disease.

Because of several factors inevitably concomitant with the commissioning of a new hospital, we were unable to carry out extensive bacteriological studies. We were unable to inoculate any animals with either the blood, sputum or nasopharyngeal washings of any of our patients. In one-sixth of the cases we examined the sputum for tubercle bacilli and the predominating type of organism. Tubercle bacilli were not found in any specimen examined. Staphylococci, streptococci, pneumococci and micrococcus catarrhalis were the predominant organisms found. When pneumococci were found present we attempted to determine the type but were unable to do so except for one case which was pneumococcus type IX. The sedimentation rate was moderately elevated in the large majority of cases.

TREATMENT

The treatment was largely symptomatic with the emphasis on rest, supportive measures and sedatives for cough and restlessness. In 12 cases sulfathiazole was administered with 30 to 90 grains given initially and 15 grains thereafter every 4 hours night and day.

We were definitely convinced that the drug was not as effective in this group as in the usual pneumococcic infections and there was considerable question as to whether it had any beneficial effects.

SUMMARY

A series of 40 cases of an acute infectious disease of the respiratory tract with unusual pathologic changes in the lung have been described and analyzed. In general our cases closely resemble those described as some type of pneumonitis by workers in the United States and abroad.

The majority of the cases in this series began as a simple acute infection with minimal respiratory and constitutional symptoms; a normal or slightly elevated leukocyte count and no abnormal physical signs. The diagnosis was usually made by means of the roentgenogram and *in the large majority of cases could not be made by any other means.* It usually showed a small area of increased density most often located at the base or hilus of one lung. Abnormal physical signs in the lungs, usually manifested by crepitant rales were not apparent until the peak of the severity of the disease had passed. Although the constitutional symptoms were not severe, a prolonged period of convalescence was usually required because of the weakness of the patient.

The pathology and etiology of this disease is still undetermined although there is some evidence to indicate that it is caused by a filtrable virus.

The disease is apparently contagious, but only mildly so, and is probably transmitted by casual contact.

Lack of physical fitness, previous upper respiratory infections, abnormal exposure, or physical fatigue were not predisposing factors.

The disease did not respond favorably to the action of sulfonamide chemotherapy.

The study of our series and the reports of other workers who have observed similar outbreaks impresses us with the fact that many factors remain to be studied before the entire field of acute respiratory infections can be charted and particularly is this true of those caused by a filtrable virus.

We agree with Francis that this can be achieved only by clinical epidemiological methods and that by comparing the clinical differences

in patients and epidemics with specific laboratory data, the various entities will fall into their proper places in the puzzle of epidemic respiratory disease.

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ACUTE RHEUMATIC FEVER [1]

A REVIEW OF 80 CASES [2]

By Lieutenant Commander Stanley Gardner, Medical Corps, United States Naval Reserve

With the increased recruiting activity in the northern naval districts and with many ships now in service in the North Atlantic, it is reasonable to assume that medical officers, ashore and afloat, will see many cases of acute rheumatic fever during the winter of 1941 and 1942.
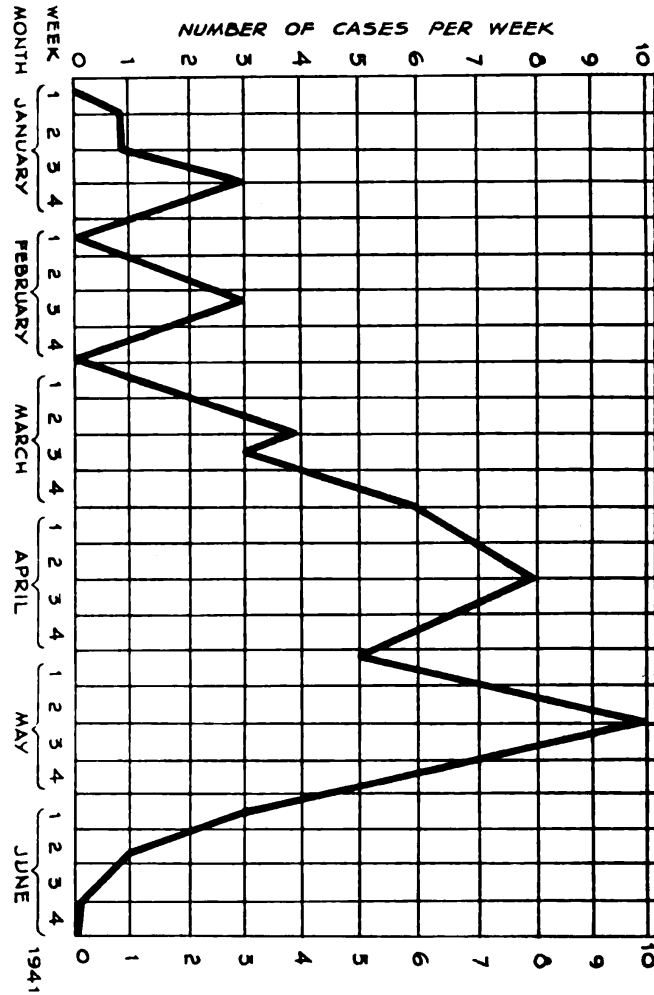
GRAPH 1.— Showing weekly admittance of patients January 1 to July 1, 1941.

ETIOLOGY—PREDISPOSING FACTORS

The location of this station in the temperate zone and the geographical distribution of patients in regard to their homes was of interest. Most of the recruits are drawn from the States comprising the Ninth Naval District, bordering on the Great Lakes. (See table 1.) These States contributed the largest number of cases. Nichol (1) notes the rarity of the disease in the South and the arid States of the Southwest.

TABLE 1.—*Geographical distribution of recruit patients*

Home State	Illinois	Wisconsin	Michigan	Ohio	Iowa	Minnesota	Kansas	Indiana	New York	Missouri	Kentucky	Tennessee	Texas	Virginia	Oregon	Georgia	Nebraska	Pennsylvania	North Dakota
Number of patients	10	7	7	7	8	7	3	5	3	6	5	2	1	1	1	1	2	2	2

It is an established fact that most of the cases occur in the late winter or early spring, during the season of storms and extreme temperature changes when tonsillitis, pharyngitis, and acute respiratory infections are most prevalent (2). In this series, the first case was observed during the second week in January. The curve rose steadily from the last week in February until the peak was reached the second week in May, after which the curve dropped sharply during the latter weeks of May to the one case admitted during the third week in June. (See graph I.)

The relation of recent acute infections was noted among this group, and it was found that within a comparatively short time, varying from 10 days to 3 weeks, 62 out of this group gave histories of recent infection. (See table 2.) Jones (3) reports 58 percent of his patients had an associated respiratory infection.

TABLE 2.—*Recent acute infections preceding attack of acute rheumatic fever*

Catarrhal fever	Tonsillitis and pharyngitis	Scarlet fever	Otitis media	Measles	German measles	No recent infection	Suppurative pleurisy
28	14	7	1	4	7	18	1

It has been observed that this disease occurs most frequently during the first three decades of life. This observation was no doubt a factor in this large series of cases reported, as most of the personnel attached to this station are young men in the second decade of life. Sixty-four

percent were in their teens, the remainder in the early twenties, and only one case in the series was in the thirties.   (See table 3.)

TABLE 3.—*Age of patients*

Age	17	18	19	20	21	22	23	24	25	27	37
Number of cases	16	19	17	10	9	2	1	1	3	1	1

Bacteriology.—The enormous amount of work which has been done by Collis (4), Colburn, Green, and many others, has failed to establish a specific organism as the cause of acute rheumatic fever, although hemolytic streptococci have been isolated from blood cultures, from heart muscle, heart valves, and other tissue at autopsy.   In this series of cases blood cultures were taken from a number of these cases, but the results were disappointing.

Symptoms.—Some observers have noted that the first symptoms to appear were those in joints under the most strain.   This was found to be true in this group, as many of the patients first complained of pain and stiffness in the feet, and shortly afterwards the ankle and knee joints were rapidly involved.   These symptoms were usually accompanied by chills and fever.   The average admission temperature ranged from 101° to 103° F.

Treatment.—On admission, all patients were made strict bed patients, as recommended by Taussig (5) and others, regardless of the severity of symptoms or joint involvement.   Those cases with painful, swollen joints were wrapped in cotton, having first received an application of 50 percent mixture of methyl salicylate in olive oil.   The limbs were supported by pillows, and with the lower extremities cradles were used to keep the weight of bed clothing from the affected joints.

In regard to drugs, a few cases were treated with the sulfonamides with very unsatisfactory results, comparable to the experience of Waddill (6), so that a return was made to the reliable and time-tested salicylates.   Sodium salicylate was the drug of choice and this was given in a solution of sodium salicylate 15 grains and sodium bicarbonate 15 grains to the drachm.   This dose was given every 4 hours for the first 24 hours, then reduced to four times a day according to the relief of symptoms.   In this series of cases very few patients complained of nausea, ringing in the ears, or other toxic symptoms.

During convalescence, patients were kept in bed until their sedimentation rate was below 15, as proposed by Cecil (7).   The average time as strict bed patients was from 4 to 5 weeks.   After this period, patients were first allowed to sit up out of bed, a few minutes at a time, with careful checking of the pulse rate.

Complications.—Thirty-four patients out of this series made an apparent recovery and were returned to duty. Forty-six patients developed cardiac complications, and these were classified as follows: Mitral insufficiency, 40 cases; mitral stenosis, 4 cases; and pulmonary stenosis, 2 cases.

Two of the above patients during the acute stage developed a severe pericarditis with a large accumulation of pericardial fluid. Both cases with conservative treatment recovered, with complete absorption of the effusion, and a return of the heart borders to normal limits. Both cases had an accompanying myocarditis and endocarditis, which persisted, so that they were eventually separated from the service by reason of medical survey.

SUMMARY

The increased number of young recruits entering the Navy in this climate, and the acute throat and respiratory infections of winter, will undoubtedly lead to a sizable number of cases of acute rheumatic fever.

The care in diagnosis and treatment of this condition is of importance because of the serious complications which follow in its wake.

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HISTORY OF PSYCHOLOGICAL EXAMINING IN THE UNITED STATES NAVY [1][2]

By Lieutenant Commander C. M. Louttit, United States Naval Reserve

While the famous psychological examining program of the Army during World War I was not adopted by the Navy, there was considerable activity by naval medical officers in the use of psychological tests in recruit selection. The earliest report on psychological examining

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[1] C. M. Louttit, Lt. Comdr., D–V (S), USNR: Psychological examining in the United States Navy; an historical summary. Psychol. Bull. 39: 199–210, 1942.

[2] An abstract of the above named article for information for the medical officers of the Navy.

was by H. Butts, who described a specially devised test in 1911. From that time until 1919 there were at least six additional tests used, of which three, by A. R. Shier, A. W. Stearns, and L. E. Bisch, were systematically developed and given to large numbers of men. Surprisingly, there seems to have been very little knowledge of what others were doing as there are no indications of any effort being made to utilize the results of the various studies for establishing a regular examination program in the Navy. After the war, in 1923, the Training Division of the Bureau of Navigation introduced the use of group classification tests at training stations, and in 1931 similar testing was started at recruiting stations. The influence of this program is suggested by a drop in percentage of recruits with mental ages below 11 years, from 17 in 1930 to 5 in 1931, a continuing decrease thereafter.

The second most frequently reported use of psychological examinations is in the selection of naval aviators. Here the first paper was published by R. P. Parsen, in 1918. In addition to this one paper, the most important reports are those of D. G. Sutton and C. G. De Foney describing an interview method of estimating personality characteristics.

Other reports describe phychological studies of officers, petty officers, fire-control plotters and listeners. The original paper includes a list of 57 references.

AUDITORY ACUITY IN SUBMARINE PERSONNEL

By Lieutenant Commander Charles W. Shilling, Medical Corps, United States Navy, and Chief Pharmacist's Mate Ira A. Everley, United States Navy

Part III

Rapid change in atmospheric pressure is often manifested by an inflammatory reaction in the middle ear, which, in turn, may lead to acute or permanent loss of auditory acuity. We have completed a study on each of these conditions, and because of their interrelationship, present them as section A and section B of part III of the series on *Auditory Acuity in Submarine Personnel.* Section A is a study of "Aero-otitis Media in Submarine Escape Training" and section B is "Hearing Loss Due to Exposure to Increased Air Pressure."

SECTION A

AERO-OTITIS MEDIA IN SURMARINE ESCAPE TRAINING [1]

At the Submarine Escape Training Tank, United States Submarine Base, New London, Conn., every candidate for "lung" training is sub-

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[1] We wish to express our appreciation to Lt. Shirley H. Baron (MC), USNR, for his counsel and aid in interpreting the damage to the ears.

jected to 50 pounds increased air pressure in the recompression chamber, as required by training regulations, prior to entering the water for actual training with the submarine escape appliance.

As the air pressure in the chamber is raised, a feeling of fullness on the ear drums is noted because of the inequality in pressure on the two sides of the drum caused by restricted air flow through the eustachian tube to the inner side of the drum in contrast to the more ready flow through the external auditory canal to the outer side of the drum.

The eustachian tube acts as a ventilating shaft and as a means of drainage for the middle ear. In the resting state its walls lie in apposition, but notwithstanding this, for the majority of those taking air pressure, it permits sufficiently rapid equalization so that no real difficulty is experienced. If any difficulty is experienced, the act of swallowing or yawning causes the dilator muscles to contract and thus the tube is opened which for many is all the additional help necessary to facilitate equalization of air pressure. Others find that by closing the mouth, holding the nose and "blowing against the ears" they can more readily facilitate the opening of the eustachian tubes and thus achieve the rapid equalization necessary in taking high-pressure air. An ear which is temporarily "blocked" may suddenly give way with a high pitched squeak which is audible to all those near the subject.

However, in some cases, none of these acts are effective in permitting equalization of pressure and if the application of air pressure is continued under these conditions, aero-otitis media results and it is with this condition that this paper is concerned.

Failure to properly ventilate the middle ear may be the result of ignorance or inexperience, but equalization or ventilation may be temporarily impossible according to Armstrong and Heim (1) because of any of the following conditions: "Stenosis of the eustachian tube as the result of acute and chronic infections of the upper part of the respiratory tract, nasal obstruction, sinusitis, tonsillitis, tumors of the nose and nasopharynx, paralysis of the soft palate or superior pharyngeal muscles, enlargement of the pharyngeal or tubal tonsil, inflammatory conditions of the eustachian tube or middle ear and scar tissue about the ostium of the eustachian tube." If such conditions exist the air pressure increase must be stopped and the subject returned to atmospheric air pressure (locked out) or there will be sharp pain in the ears accompanied by damage to the drum and middle ear.

This damage Armstrong and Heim (1) have called aero-otitis media

* * * an acute or chronic traumatic inflammation of the middle ear caused by a pressure difference between the air in the tympanic cavity and that of the surrounding atmosphere, commonly occuring during changes of altitude

in airplane flights and characterized by inflammation, discomfort, pain, tinnitus, and deafness.

Lovelace, Mayo, and Boothby (2) say:

Aero-otitis media is caused by the lack of ventilation of the middle ear during changes in atmospheric pressure to such an extent that traumatization occurs in the tympanic cavity.

At this point it might be well to note that whereas the pressure difference between atmospheric pressure (760 mm. Hg.) and 18,000 feet (380 mm. Hg.) is only 380 mm. of mercury, the difference between atmospheric pressure and 50 pounds (gage) increased air pressure is 2,585 mm. of mercury.

In our experience, the damage which can be noted with the otoscope ranges all the way from very slight congestion through marked congestion or inflammation, retraction, bleb formation caused by actual hemorrhrage into the drum membrane, to complete rupture of the drum with frank hemorrhage from both the external canal and the eustachian tube. To the uninitiated, it is truly alarming to look at an ear that a few minutes before was white, glistening and normal and see a fiery red drum so congested and retracted as to cause obliteration of all normal landmarks and covered with bubble-like bulges caused either by air or hemorrhage disecting the strata of the drum membrane. Often this active congestion and hemorrhage extends onto the walls of the external auditory canal and must also extend into the tympanic cavity for blood at times comes from the eustachian tube in the absence of a rupture of the drum membrane.

Manigan (3) found "a fully retracted drum", "ecchymotic hemorrhages into the drum" and "inflammation around the pharyngeal opening of the eustachian tube." He also reports, "hemorrhagic blebs in the external aural canal or on the drum membrane as the result of air trapped in the middle ear."

The individual complaints vary with the degree of damage from a mild feeling of fullness or "water in the ears" to excruciating pain. Deafness, either partial or complete, is an almost constant complaint. Tinnitus is a frequent complaint.

Some subjects experience severe pain in their sinuses, usually the frontal. This pain may be noted first when the pressure is being built up. It may be lancelike and momentary, but frequently is steady and severe enough to necessitate the pressure being stopped and the subject "locked out" to normal air pressure again.

Nosebleed is occasionally encountered probably because of excessive trauma when holding the nose and "blowing against the ears." Bleeding, of course, occasionally comes from sinuses. Cases of severe toothache have at times developed under pressure which were relieved

upon return to atmospheric pressure. Hidden cavities and leaky fillings have been invariably found in these cases.

A few case histories may serve to illustrate more clearly the various types of damage encountered in attempting to take 50 pounds increased air pressure.

CASE REPORTS

Patient T.—January 13, 1941. Complained of pain in both ears, which was of such severity that air pressure increase was halted at 7 pounds and the subject put in the outer lock where the air pressure was slowly dropped to normal atmospheric pressure while the others in the main compartment continued to increase the pressure until reaching 50 pounds. Examination revealed moderate congestion of both drums. By next morning there was evidence of clearing of the condition and by the 16th of January he was considered to be ready to try it again.

Patient N.—December 23, 1940. Unable to take more than 20 pounds pressure so was "locked out" as described above. Complained of pain in the left ear only. Examination revealed right ear normal but left with marked congestion, retraction and bubblelike areas of hemorrhage into the drum membrane. Spit out considerable blood-streaked material draining from left eustachian tube. December 24.—Some lessening of congestion. December 26: clearing nicely with areas of hemorrhage becoming deep purple. December 27: clearing continues with areas of hemorrhage showing organization with change to orange brown color. January 22, 1941: left drum completely cleared of acute condition but dull, thickened and showing areas resembling scars.

Patient Ni.—January 6, 1941. "Locked out" of pressure at 12 pounds. Complained of pain in the region of the frontal and ethmoidal sinuses. The frontal sinuses were cloudy to translumination and by x-ray also showed involvement. January 7: Pain continues despite local heat and shrinkage of nasal mucous membrane. January 8: As pain continues patient turned in sick bay for continuous treatment. January 13: Discharged to duty, free from pain.

Patient C.—January 2, 1941. At the original ear examination both drums were dull, scarred and retracted, and the left had a large white plaque around the periphery and also a very thin translucent area just off center at about 4:30 o'clock. He was advised of the condition but since he was an officer candidate for Submarine School who had been sent a long distance, he was allowed to attempt "lung training". While taking pressure, he noted pain in his left ear and then a feeling as if something had given away followed by relief of pain. He completed his training and reported to the Submarine Medical Examiner. A large perforation with ragged edges was found to have completely replaced the thin area noted prior to taking pressure. The ear remained clean and dry and the drum healed over by the 18th of January but the area of the scar is so large and thin that it will undoubtedly rupture again at the least pressure.

Patient D.—November 8, 1940. Took 50 pounds pressure without any difficulty but as the pressure was being dropped felt slight pain and there suddenly appeared a marked hemorrhage of the left ear and of the nose. Contrary to instructions this man "held his nose and blew" while pressure was being dropped, thus inhibiting equalization of pressure. Examination of left ear after cessation of hemorrhage and cleaning out of canal revealed a drum which was a deep purplish-red with a rupture of fair size on the periphery of the drum at 11:30 o'clock (pars flaccida), with blood still dripping from the perforation. Examination of the right ear showed marked congestion, bulging and evidence

of hemorrhage into the drum membrane but no rupture. Because of the danger of infection, the man was turned in on the ward where the ward medical officer wanted to lance the right ear, refusing to believe that it had been normal upon examination less than an hour before. November 30: The right ear has cleared except for an area of organizing hemorrhage now brownish purple in color. The left ear drum however, is purplish-black in its entirety and devoid of the normal landmarks although the ruptured area has healed over. December 3: Both ears are almost normal except that the drums are dull and thickened and a brownish area still persists in the right ear.

Patient M.—January 8, 1941. Completed the pressure and the "lung" training but had continual pain in left ear since that time until reporting to sick bay on January 11 at which time there was marked bulging of drum with evidence of acute inflammation. Was given local treatment and general sedation but on January 12 condition was worse and a paracentesis was done with a heavy drainage of pus and marked relief of pain. Ear drained for a few days but eventually healed without complication. Although a mild upper respiratory infection was present at the time of admission on the 11th of January, it is believed that the otitis-media had its origin in the air pressure experience on the 8th as the pain had continued from that time.

Patient L.—Developed acute mastoiditis requiring immediate hospitalization. This developed almost immediately following a painful pressure exposure and there can be no doubt as to the etiology.

It is worthy of note that during the fiscal year July 1, 1940, to June 30, 1941, in which this study was undertaken, there were 4,333 officers and men examined for "lung" training. Of this number there were 256 turned down from the following defects: Catarrhal condition of upper respiratory tract, 109; otitis externa, 48; tachycardia, 35; hypertension, 38; other general causes, 24. There were an additional 222 who failed to equalize pressure and were thus, at least temporarily, prevented from completing training. These conditions were in the main, only temporary for there were but 19 who were permanently disqualified and taken off submarines; 9 because of failure to equalize pressure; and 10 because of defects, noted during the physical examination, of a nature serious enough to necessitate disqualification.

Two thousand seven hundred and fifty-one of the men taking the 50-pound pressure test were included in this study. Of these, 1,866 were taking pressure for the first time, 44 had tried before but never successfully completed the pressure test, and 941 had the pressure 1 or more times previously. Of the men taking pressure for the first time there were 152 men having ear trouble of sufficient severity to cause them to be "locked out" of the chamber before completing the test. This usually occurred before reaching 10 pounds. In addition, there were 139 men who had enough trouble to require the increase of air pressure to be stopped 1 or more times during the test. Of the experienced men taking pressure, there were 55 "locked out" and 25 who had to stop in order to equalize. Sinus pain forced a total of

9 men to come out of the tank while, in addition, there were 26 who experienced pain while the air pressure was increasing, and 9 who experienced it during the dropping of the pressure. There were 40 men who experienced nosebleed during or immediately following the pressure test.

The clinical entity termed "areo-otitis media" is new only in its application to aviation medicine since traumatic pressure injury to the middle ear was observed and described as early as 1896 when Alt (4) reported three cases of "apoplectiform labyrinthitis" in caisson workers. However, his cases may have been due to compressed-air illness for as Anthony (5) says:

> There are two main types of ear trauma, one where the symptoms are part of the symptom complex of caisson disease and produced by nitrogen bubbles in the cochlear and vestibular apparatus, the other where they are directly due to the action of the compressed air.

We know that as early as 1900 this distinction was clearly understood for Heller, Mager, and von Schrotter (6) divided their cases of ear trauma in caisson workers into two groups. The first group consisted of cases of temporary deafness and vertigo caused by compression. The second group was composed of the cases which showed "Meniere's syndrome" and in which the aural lesions were thought to be due to nitrogen bubbles.

In 1909 Keays (7) reported on 3,692 cases of compressed-air illness. Of these, vertigo without other symptoms was noted in 113 cases, pains in the ears, hemorrhages from them and temporary deafness in 68 cases, Meniere's symptom-complex in 14 cases and apoplectiform deafness in 2 cases. Two years later Bassoe (8) reported that 87 men of a group of 161 caisson disease cases gave a history of ear affections, 33 complained of dizziness, and rupture of the drum occurred in 2 cases.

Silberstern (9) in 1912 reported on 190 cases of caisson disease including 11 cases of hyperemia of the ear drum, 12 of hemorrhage into the tympanum, 3 cases of myringitis and 1 case of suppurative otitis media. In the same year Hill (10) wrote his book on diving in which he says:

> The cases of ear trouble were of two kinds: 1. Cases of temporary deafness and vertigo, lasting not more than 8 to 14 days, and caused by nonequalization of the pressure on either side of the drum during compression. The tympanic membrane showed signs of congestion, and there appeared in some cases hemorrhages either in its substance or in the middle ear. Bloodstained sputum might be coughed up from the back of the throat, the blood coming from the Eustachian tube. 2. Cases of Menieres Complex, vertigo, vomiting and deafness—symptoms which might persist indefinitely, and were caused by lesions produced by air bubbles either in the central tracts of the cochlear vestibular nerve or in the internal labyrinth of the ear.

Anthony (5) in his excellent study of 70 cases of compressed air injuries to the ears and accessory sinuses occurring in the Memphis tunnels reports that

Pain occurred in each of the 70 cases of compressed air injuries that I have seen. Eighteen cases complained of coughing up bloody secretion or of having a bloody discharge from the nose, 19 cases complained of vertigo, 7 cases complained of severe tinnitus, 3 cases showed nystagmus which cleared up within 1 week, and 1 case complained of double vision, but the diplopia lasted only 2 or 3 days. Thirty-four cases complained of marked deafness in one or both ears. Fifty-five of these cases gave a history of having had an upper respiratory infection before entering the tunnel of compressed air, and on examination, I found that at least 95 percent of the cases had evidence of an upper respiratory infection.

Sixty-nine of the seventy compressed air injuries had ear injuries. The injury was bilateral in 31 cases and affected only 1 ear in 38 cases. There were 52 cases of acute congestion of the ear drum, 23 cases of hemorrhage in the drum, 19 cases of perilabyrinthitis, 9 cases of otitis media, purulent acute, in each of which it was necessary to incise the ear drum, and 2 cases of acute mastoiditis.

The question of rupture of the tympanic membrane is one of great interest. All those working with compressed air have seen cases and those reporting in the literature all agree that it does occur. Dewatripont (11) reports that

Because of too rapid compression and also decompression, 18 have suffered a rupture of both tympanic membrane, 3 of 1; at least the latter said to us that the blood drained from but 1 ear, but it is possible that the drum of the other was ruptured also without external drainage of the blood being produced.

This quotation brings up a most interesting problem, for he evidently is assuming that because there is frank hemorrhage from the external ear there must be a rupture of the tympanic membrane. This is in error, for it frequently occurs that there is a hemorrhage into the tympanic membrane with disection of either the very thin outer epithelial layer or the equally thin inner layer from the middle fibrous layer, and on occasions there is a rupture of either of these thin covering membranes allowing frank hemorrhage without a complete rupture through the entire tympanic membrane. As was noted above, Silberstern (9) reported "12 hemorrhages into the tympanum" but he does not mention a single case of complete rupture of the drum. As noted earlier in this paper, hemorrhagic blebs and air bubbles have often been observed in the drum membrane itself. Blood has been noted coming from the external canal or from a eustachian tube, and, upon examination, no complete perforation of the drum could be demonstrated. This is not to say that perforation cannot occur for it does; but it is simply a warning not to assume a complete perforation because of hemorrhage. Guttich (12), (13), (14) presents animal experimental work and observations on men to prove that in rupture of the ear drum while diving or swimming under water, there

is a flow of water into the middle ear causing such marked dizziness and loss of balance that without outside help the individual would not be able to make his way to the surface and would drown. "That death due to this type of vestibular imbalance is possible in swimmers cannot be doubted." He advises great care in deep diving especially in cold water and the wearing of oiled cotton in the external auditory canals. Van Dishoeck (15) has developed a pneumophone for the measurement of resistance of eustachian tubes in caisson workers.

United States naval records on this condition are incomplete since many never report for treatment, others are treated as ambulatory patients and are not admitted to the sick list even for record, and others are given the disease diagnosis of Otitis Media. The proper diagnosis for these cases is rupture, traumatic, tympanum No. 2548, Speciality letter U, for diving and submarine escape appliance. The Annual Report of the Surgeon General, United States Navy lists no such injuries for 1935, 1936, 1937, and 1938 but does list two cases for 1939. Vail (16) in 1929 quoted from a letter from the Surgeon General of the Navy saying that there were "no admissions to the sick list for damage to the ears that could be considered due to diving activity." He also quotes Lt. Comdr. G. H. Mankin with whom we agree when he says:

As is well known, the incidence of damage to the ear drums among diving personnel of the Navy is much greater than would appear from a study of the vital statistics published in the Surgeon General's annual report. This state of affairs obtains for one of two reasons: the condition is overshadowed by some other incident of diving more serious in nature or the ear damage is insufficient to warrant placing the diver on the sick list with the sending of the customary notice to the Bureau of Medicine and Surgery.

Vail himself reports two cases of complete rupture of the drum, one in three places with bleeding from the nose and from the affected ear. Proper recording and reporting of this condition is of extreme importance not only because of the danger of immediate complications but also because of the frequently associated diminution of auditory acuity.

As noted in the illustrative case histories; complications range from otitis media to mastoiditis but the most frequent and also the most serious complication of aero-otitis media is the associated loss of auditory acuity. This is completely considered in section B of this paper, but it is important at this time to emphasize that the loss may at times be sufficiently great to be disabling; and that it may take as much as a month to clear in favorable cases and in some cases may never return to normal.

Treatment of a conservative nature has been most effective in our series. In some of the first cases treated an attempt was made

to equalize the air pressure by the use of an eustachian catheter or the Politzer bag but no more relief was obtained than by instillation of warm soothing oil to the ear. Anthony (5) tried inflation of the eustachian tubes in 25 percent of his cases but found no benefit and, in fact, says it is contra-indicated because of the frequently associated inflammation of the eustachian tube. At the present time "auralgan" in the external ears and shrinking of the mucous membrane of the nose by spraying with an ephedrine inhalant is used exclusively in the treatment of these ears with excellent results. Manigan (3) recommends conservative treatment and advises against inflation or myringotomy, even in the presence of a bulging drum membrane. For the restoration of normal hearing, time is the only treatment available, as it is necessary to await the organization and final absorption of the blood and serum in both the drum membrane itself and in the inner ear.

The alleviation of this condition by the inhalation of helium-oxygen mixtures was advocated in 1939 by Lovelace, Mayo, and Boothby (2) because of the increased speed with which it would diffuse through the eustachian tube into the middle ear. Crosson, Jones, and Sayers (17) in the work on the Queens Midtown Tunnel in New York City found that 82 out of 84 locked out because of blocked ears were able to reenter the pressure chamber without difficulty after breathing a helium-oxygen mixture for 3 minutes. Requarth (18) found not only that great immediate relief was obtained by breathing the helium-oxygen mixture but that he had much less "infection and suppuration" in the ears of the helium treated cases.

PREVENTION

Prevention rests largely upon careful physical examination to eliminate men suffering from any acute or chronic upper respiratory infection, common head cold, acute or chronic tonsillitis, pharyngitis, sinusitis, otitis, or marked obstruction of the nasal passages by polyps or deviated nasal septum.

The use of the helium-oxygen mixture during the taking of the pressure was advocated by the authors already quoted and by Hall (19) and has proven to be of undoubted value in assisting the men to take pressure without injury to the tympanic membrane.

Educational measures leading to a complete understanding of the value of swallowing, yawning and the use of the Valsalva inflation of the ear are of distinct value and should never be neglected.

If extensive pressure exposure is anticipated, a preexposure audiometric study should be made both as a safeguard to the workman and to the employer.

SUMMARY

A study of 152 cases of aero-otitis media occurring in men undergoing submarine escape training is presented, with complete illustrative case histories.

The anatomy, physiology, etiology, symptomatology, pathology, treatment and phophylaxis are discussed in some detail.

Special mention is made of the necessity for accurate reporting of these cases because of the complication of diminished auditory acuity.

SECTION B

HEARING LOSS DUE TO EXPOSURE TO INCREASED AIR PRESSURE

A. Acute Loss.—The acute hearing loss as pointed out in section A, is usually part of the picture of aero-otitis media and results from damage to the middle ear occurring when the individual is unable to equalize the air pressure in the middle ear. This is most often caused by temporary or permanent nonpatency of the eustachian tube. In these cases, the hearing usually returns to normal within a few days but may be delayed for months in cases of severe damage and, in some cases, complete return to normal never occurs.

TABLE 1.—*Hearing loss in terms of decibels or sensation units*

Frequency (cycles)	128	256	512	1,024	2,048	4,096	8,192
Aero-Otitis Media	17.3	22.6	21.5	20.0	20.8	35.6	32.3
Our normal—Identical ages	−0.3	4.7	6.7	−0.3	8.1	9.7	8.6
Our normal—Entire group ages 25–34	1.2	4.7	7.1	−0.4	5.6	14.0	16.3

As will be noted by reference to table 1 and as is shown in figure 1, there is an almost uniform loss of 20 decibels for each frequency between the acute aero-otitis media cases and the normal groups. That this 20-decibel loss was of the conduction type of deafness was demonstrated by both audiometric and tuning-fork studies. Tinnitus was present in a number of cases. The degree of damage observed by otoscopic examination was not consistently reflected in the loss of hearing as determined by audiometry. However, it is probable that were it possible to see the midlde or inner ear, damage would be seen to more closely parallel the hearing loss. As pointed out by Requarth (18) :

In cases of more severe otitis the middle ear is filled with serosanguineous fluid, the drum is a dark bluish red and there is a middle-ear type of deafness. The less severe disorders subside in 24 to 48 hours, the drum resumes

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its normal appearance, and the hearing is unimpaired. Aero-otitis media as-sociated with much fluid in the middle ear resolves slowly over a period of several days to several weeks. Hearing returns as the fluid resolves. In a significant number of patients the fluid becomes infected, perforation occurs, and typical suppurative otitis media results.

Hearing loss in a number of cases increased on the second and third days. This may be explained by coagulation of the extrav-asated blood in the ear drum and/or the middle ear, causing de-
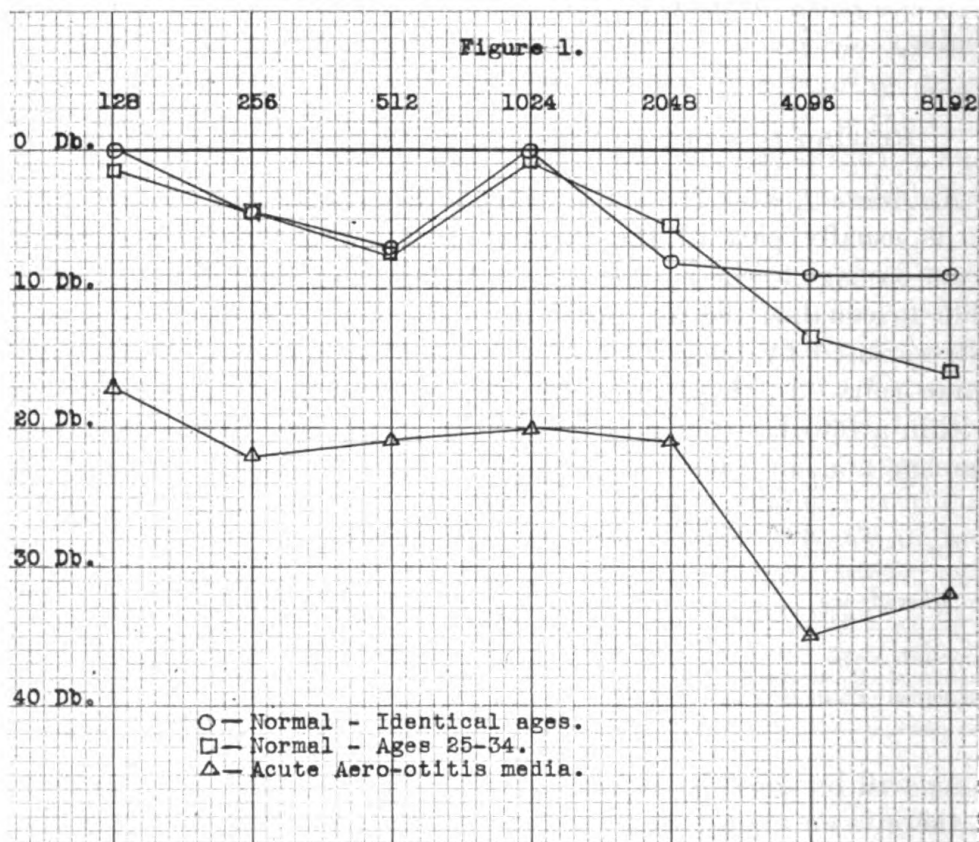
FIGURE 1.—Acute hearing loss associated with acute aero-otitis media as com-pared with normal groups. The "aero-otitis" curve is the average of 18 recent aero-otitis media cases tested for auditory acuity. The "same age" normal group is the average hearing found in a like number of men of identical ages taken from our general "normal" groups. The other normal group is our entire normal or control group for "ages 25–34."

creased mobility and difficulty of sound transmission. Another con-sideration is that damage to the drum and middle ear is caused by partial or complete blockage of the eustachian tube and in the attempt to take the pressure there is trauma which causes increased swelling of the mucosa in or around the naso-pharyngeal opening of the eustachian tube tending to produce complete occlusion. With this condition existing there will follow absorption of the oxygen from

the air trapped in the middle ear, and this in turn will cause a cupping effect which will lead to further damage and contraction of the drum causing increased pressure on the ossicles. This may be severe enough to not only cause fixation of the chain but to jam the stapes into the oval window causing damage to the inner ear. The tinnitus, experienced by many, may be caused by this damage or may be an air-pressure phenomenon. This increased loss on the second and third day is well demonstrated in the case of M. L. W. shown in figure 2.

The case of J. D. S., figure 3, clearly demonstrates the fact that loss of auditory acuity is associated with aero-otitis media caused by failure to equalize air pressure, for in this case the right ear was not damaged in the least and suffered no auditory loss, whereas the left ear was damaged on three attempts at taking air pressure and showed marked loss of auditory acuity. Only the left ear is shown in figure 3.

That severe damage to the middle ear and the ear drum leads to marked loss of auditory acuity is shown by the cases of Dewatripont (11).

He reports 18 cases having suffered a rupture of both tympanic membranes and 3 of 1, due to "too rapid compression and also decompression." Of this group, "progressive deafness was started with all of them; 5 have a slight loss of hearing on 1 side and a medium or 5 percent loss on the other; 6 have a bilateral medium loss of 10 percent; 3 in 1 ear a medium loss and in the other a sharp loss, 15 percent; 2 having in 1 ear a sharp hearing loss and in the other a remarkable loss, 20 percent; 1 with marked tinnitus, 25 percent; 1 does not perceive in any manner the whispered voice at more than 10 centimeters and the conversational voice at more than 50 centimeters, therefore, attaining a bilateral deafness quite complete, 30 percent; 1 does not hear the watch nor the whispered voice, nor any tuning fork, nor even the conversational voice near to the ears and must be considered as attaining a complete bilateral deafness, 40 percent; and 1 has on 1 side a sharp hearing loss and on the other complete deafness, 50 percent; and also is subject to intense and frequent vertigo."

It should be noted that the diagnosis of perforation was made in several of these cases from a history of hemorrhage and we know that hemorrhage may occur in acute aero-otitis media without complete rupture of the drum.

Although in the cases presented in this paper the damage has been caused by pressure in excess of one atmosphere, it is equally likely to occur, as pointed out by Armstrong and Heim (1), in aviators upon too rapid return from a rarified atmosphere to atmospheric pressure. It seems certain that loss of auditory acuity must also be associated with damage to the ears under these conditions. In 1935, Armstrong (21) in reporting a free fall in space, reported an apparent diminution of hearing acuity probably due
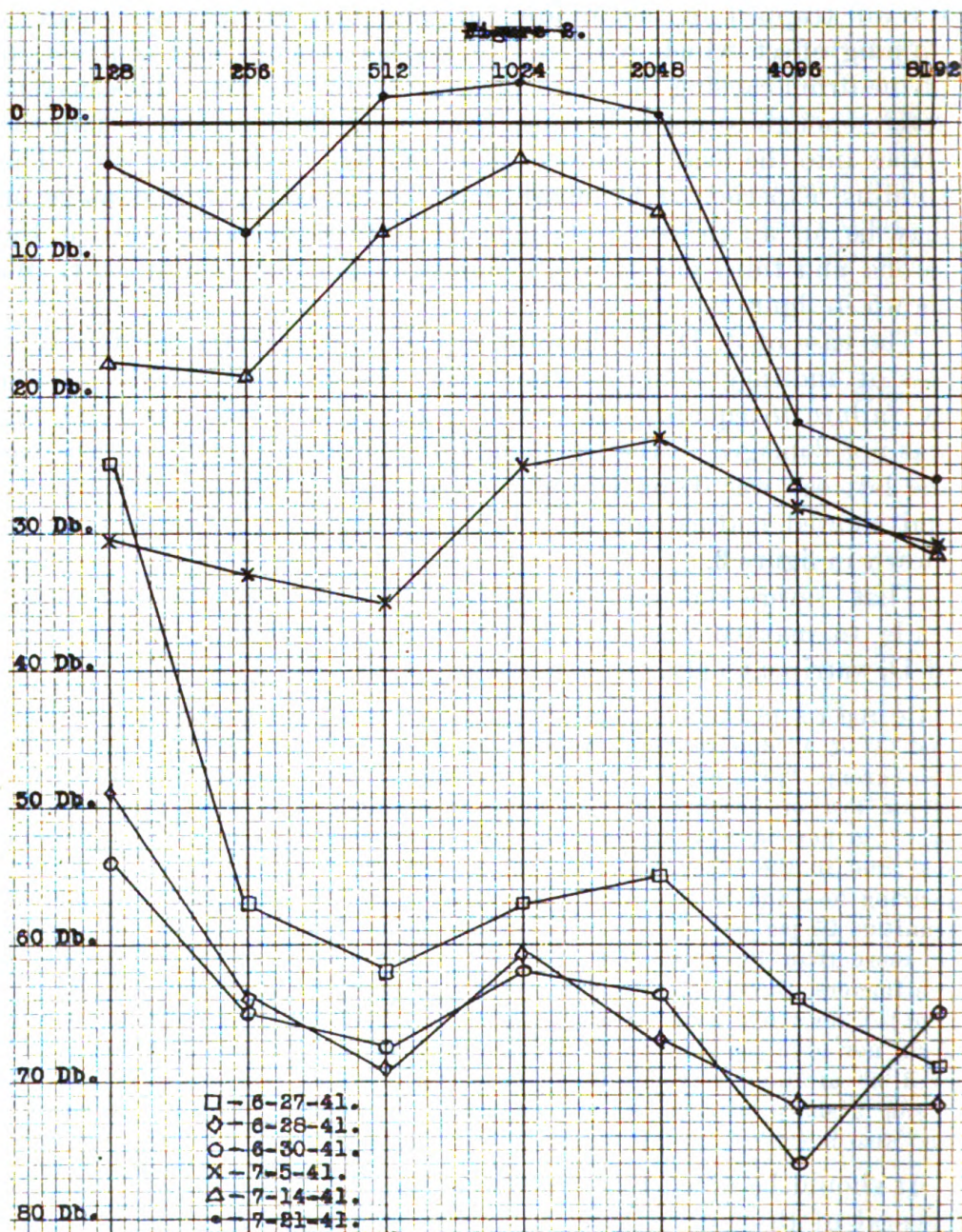
FIGURE 2.—M. L. W., Sea. 2c. Age 18 years. Six months naval service. No submarine duty and no history of previous acoustical trauma or predisposing disease. Failed in an attempt to take pressure on 6–27–41 because of pain in both ears, necessitating locking out at 22 pounds. Both ear drums showed marked congestion with engorgement of blood vessels and marked retraction. The original audiogram done on the same day shows an average loss of 55.6 db for all frequencies which is a remarkable loss but, on the second day (6–8–41), there was an additional loss amounting to an average of 9.1 db making a total average of 64.7 db for all frequencies. As will be noted, there was a substantial gain in auditory acuity during the first week; however, almost a month elapsed before return to normal and even then there was not complete recovery for the frequencies 4096 and 8192.
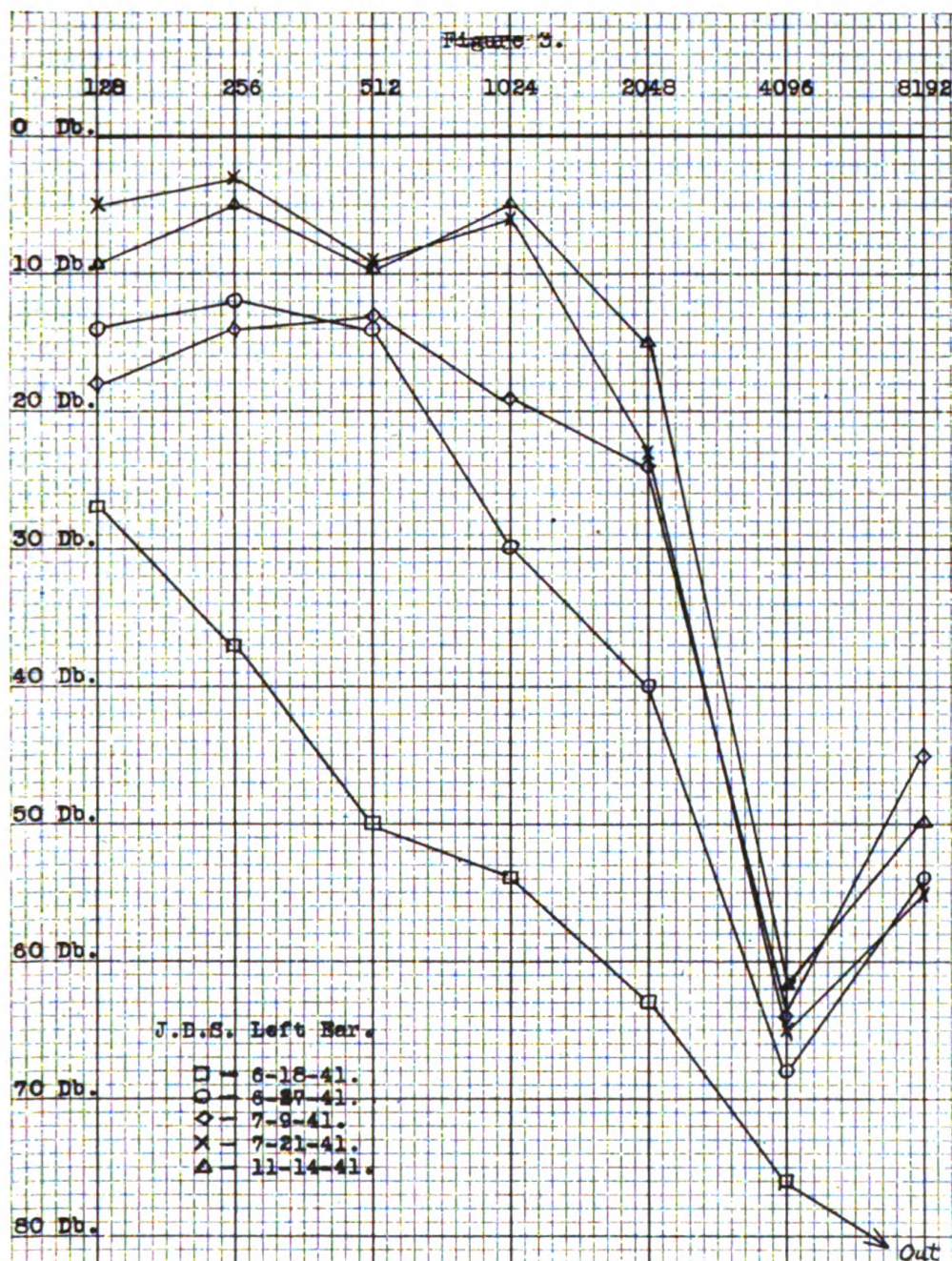
FIGURE 3.—J. D. S., Sea. 2c. Age 17 years. Six months naval service. No history of auditory trauma or predisposing disease. Failed pressure attempt 5–27–41 because of pain left ear. Failed second attempt 6–4–41 again pain left ear. Third attempt 6–17–41 failed as above. Left ear otoscopic examination revealed marked congestion, actual hemorrhage into drum and bubble formation. Tinnitus—frequency 9747 amplitude plus 10 db was an early and distressing symptom. The right ear remained normal at all times both otologically and by audiogram. This figure presents five of many audiograms taken in this case. It will be noted that although the recovery has been marked and is almost complete in the middle and lower frequencies, on the two higher frequencies marked loss still exists after a period of 5 months, and the prognosis is unfavorable for complete recovery.

to "atmospheric conditions." In 16 cases presented by Lovelace, Mayo, and Boothby (2) experiencing difficulty with the ears during rapid descent from a high altitude, subjective deafness was a symptom in 7, 1 complained of tinnitus, and all experienced a feeling of fullness or pain in the ears. This loss of hearing in the aviators becomes of particular significance during flight when voice communication is necessary.

Great care should be exercised in all activities where individuals are exposed to high pressure air in order to preclude this damage. As stated in section A, careful physical examination, particularly of the ear, nose, and throat, and proper instruction in the methods of clearing the ears are of prime importance.

It is fully realized that no fine line of demarcation can be drawn between acute and chronic or permanent loss. Acute damage may result from aero-otitis media and if not severe it may clear quickly and completely. On the other hand, the damage may be sufficiently severe that permanent loss will result. In like manner the damage purported to occur as the result of compressed-air illness is usually reported in the literature to be acute or sudden in its onset, but by most authors is said to be more apt to result in permanent loss of hearing than the damage caused by too rapid compression. For this reason the subject of hearing loss due to compressed-air illness is discussed under the heading of permanent loss.

B. Permanent Loss.—As pointed out above, permanent damage to hearing, particularly in the higher frequencies, may result in any case where damage to the middle ear has been extensive. This is well illustrated by the two cases (figures 2 and 3) presented under acute loss. Boot (22) reports 13 cases of hearing loss in caisson workers and says:

The most characteristic result of work under compressed air is a loss of the upper tone limit corresponding in type to the loss of hearing due to working in extremely noisy places such as, for instance, in boilermaking shops. It appears to be a slow degeneration that, starting at the upper limit of hearing, gradually extends downwards. The amount of deafness of this type occurring in caisson workers corresponds to some extent to the time the patient has spent working under complessed air.

He does report that some of the men were "blocked" several times, i. e., failure to equalize pressure resulting in aero-otitis media, but still credits routine pressure exposure as the cause of the deafness.

TABLE 2.—*Hearing loss in terms of decibels or sensation units*

Frequency (cycles)	128	256	512	1,024	2,048	4,096	8,192
Divers—"Pure" mean age 30.3 years	2.3	8.0	11.9	4.6	12.0	27.8	24.5
Our normal—Ages 25–34 years	1.2	4.7	7.1	—0.4	5.6	14.0	16.3
Divers—"Misc." mean age 37.3 years	6.0	14.7	17.0	9.2	21.3	46.3	39.3
P. H. normal—Ages 35–44 years	3.8	8.6	8.0	3.0	4.2	26.2	21.7

Were permanent loss of hearing likely to occur from exposure to high-pressure air, *per se*, then deep-sea divers would show marked diminution of auditory acuity, for no group of individuals in the naval service are exposed to high-pressure air more frequently than are deep-sea divers. Yet, in our experience, they do not develop extensive loss of hearing, due undoubtedly to the fact that as a group they encounter little or no difficulty in equalizing air pressure and, therefore, do not develop aero-otitis media and its associated damage to the mechanism of hearing. This is illustrated by table 2
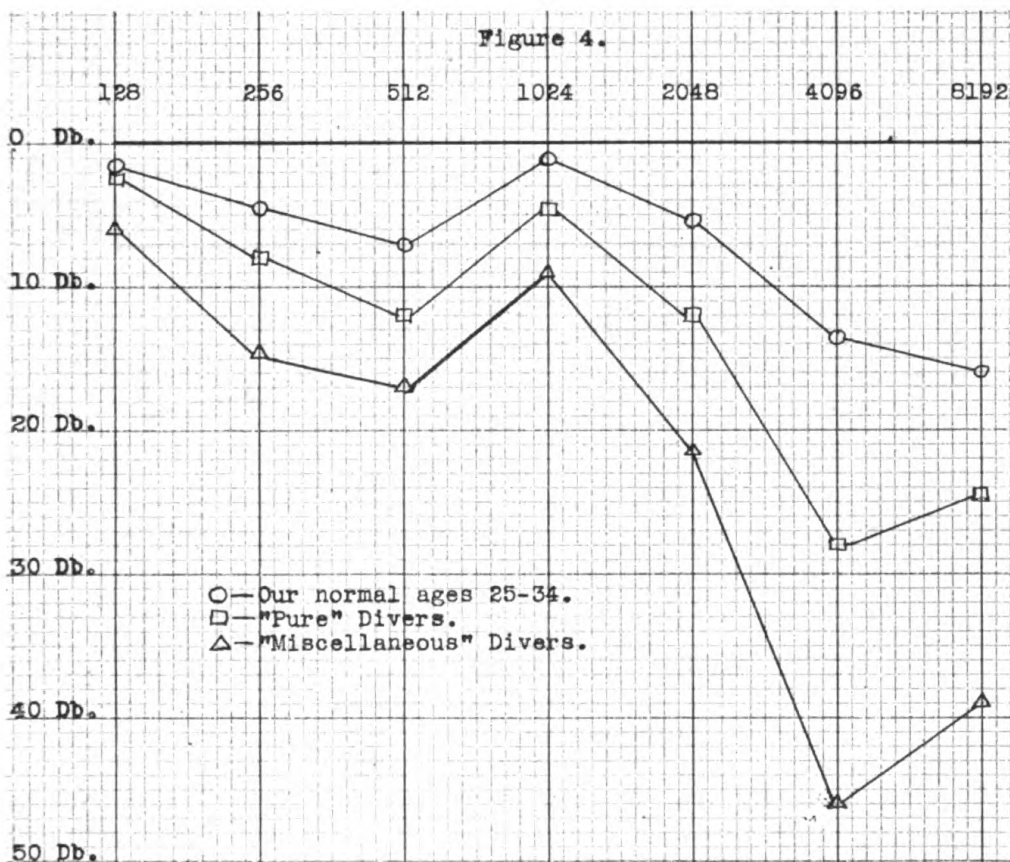
FIGURE 4.

and figure 4 where the loss of auditory acuity to the "pure" divers is very little greater than would be expected for their age alone. Even this slightly increased loss, we believe, is due to certain individuals in the group who have, on occasion, had difficulty in equalizing pressure and show considerable loss which, of course, adversely affects the general average for the divers' group as a whole. The "miscellaneous" group, as would be expected, because of additional trauma, infection, and disease, shows a somewhat greater loss.

The authors have, during the past 12 years, consistently been exposed to high-pressure air up to 10 atmospheres absolute and yet

the average auditory acuity for one of us is 1.0 db above the normal for all frequencies and the other shows only an average loss of 5 db for all frequencies, which is less than would be expected for his age group. Thus, it is again demonstrated that the taking of pressure is, in itself, not the cause of loss of auditory acuity, but that such loss is associated with damage to the middle ear due to inability to equalize air pressure. The author, whose hearing is most acute, has had mild compressed-air illness on three occasions but has never had difficulty in taking air pressure; whereas, the other has, on two occasions, had slight aero-otitis media due to inability to equalize pressure and has never had compressed-air illness.

"Pure" cases showing permanent damage are presented in figures 5

FREQUENCY IN CYCLES PER SECOND
AIR CONDUCTION: RIGHT O   LEFT X
FIGURE 5.—Permanent loss "pure" diver.
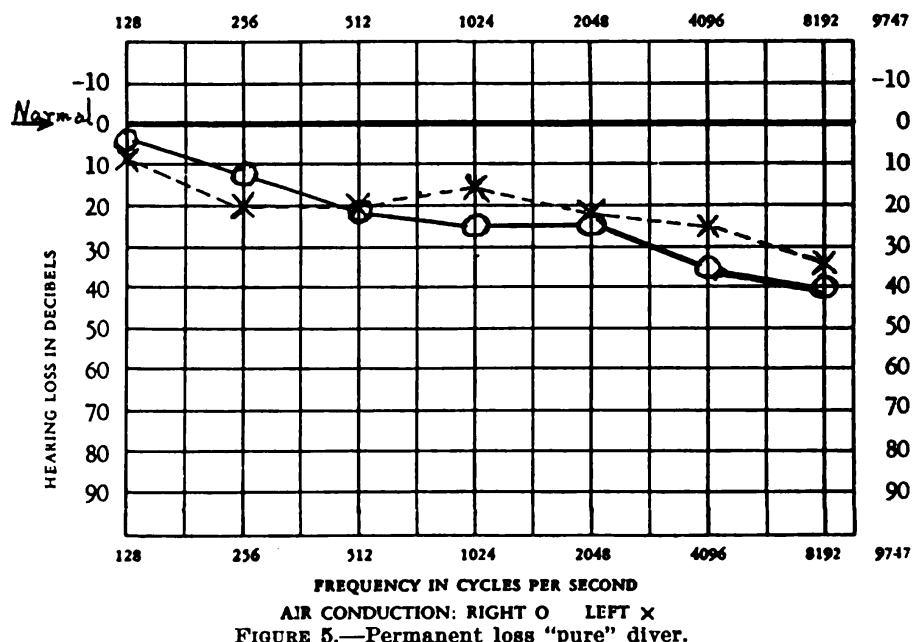
A. J. V., T. M. 1c. Age 35 years. Seventeen years naval service. Ninety-six months diving duty. No submarine service. Had mild fungus infection left ear. Had no difficulty taking pressure at any time. Both ear drums dull. Watch tick right 32/40. Examination otherwise negative.

and 6. Neither of these cases shows very marked loss of hearing although by comparison with figure 4, it will be noted that both are below the average hearing loss for the entire group. The two "miscellaneous" cases presented in figures 7 and 8, as would be expected, show more marked loss. One of them, E. A. C., was dropped to a depth of 90 feet without being checked, and he suffered a severe injury to his right ear which undoubtedly caused the permanent loss of hearing in that ear. The other case, J. C. H., was also dropped, causing rupture of his left ear followed by acute otitis media. This is also reflected in extensive loss of hearing in the left ear. Both

of these men must have suffered from acute aero-otitis media as a result of these accidents.

The association of deafness with compressed-air illness has for years been reported in the literature. However, differentiation between the damage caused to the ears by too rapid compression as compared with damage following the development of compressed air illness has not been clearly made. Among the earliest authors to make a clear distinction were Heller, Mager, and von Schrotter (6) who divided their cases of ear trauma in caisson workers into two groups. The first group consisted of cases of temporary deafness and vertigo caused by compression. The second group was com-
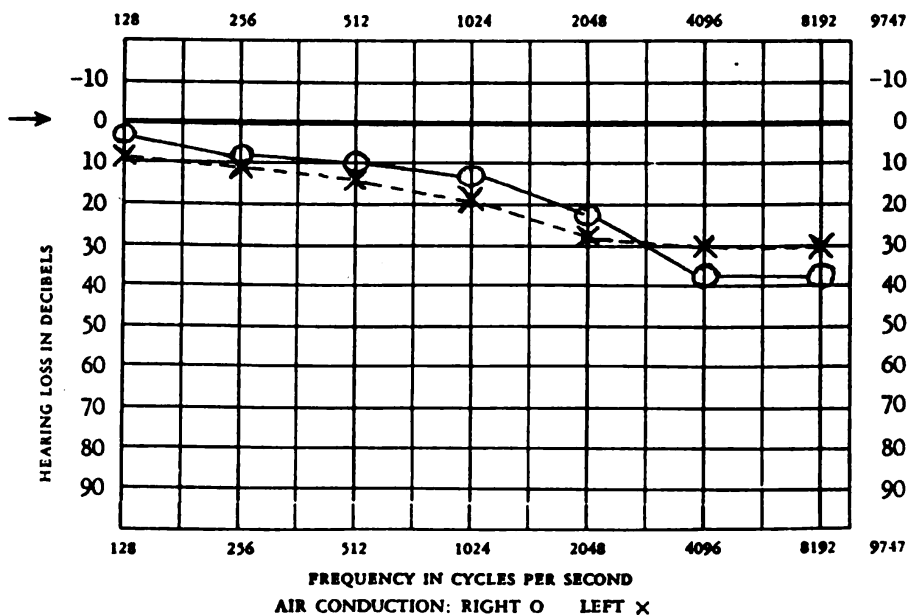
FIGURE 6.—Permanent loss "pure" diver.

C. N., B. M. 1c. Age 29 years. Twelve years' naval service. Sixty-six months' diving duty. No submarine service. Had no difficulty taking pressure at any time. "Lung" training twice. Both ear drums dull and retracted. Watch tick right 26/40. Left 28/40. Examination otherwise negative.

posed of the cases which showed "Meniere's syndrome" and in which the aural lesions were thought to be due to nitrogen bubbles.

Lestienne (23) reports a most interesting case which must be considered to be due to bubble formation:

Worked 7 hrs. in a caisson depth 24 meters . . . decompression lasting 35 minutes . . . in free air 20 minutes . . . stricken sharply with intense vertigo . . . vomiting . . . violent tinnitis, especially left ear . . . rapidly progressive and bilateral deafness . . . could not hear yells.

His condition improved somewhat but in left ear 7 months later there was still marked deafness. Although he says that his cases are all due to errors in decompression, he points out that damage

may be caused by injudicious compression but that these accidents are not either as common nor as serious in the production of deafness.

Bunch (24) reports two cases of almost total loss of hearing as caisson deafness but insofar as his report is concerned, neither compressed-air illness nor aero-otitis media were considered as causative factors. Vail (16) reports cases of deafness due to errors in both compression and decompression, and he says that in the first group the hearing loss may be temporary or permanent, whereas in the second group they are usually permanent. Malan (25) studied the acoustic function both before and after compression and reports the damage produced upon the physiological function of the ear.

In figures 9 and 10, we present two cases of men who have had
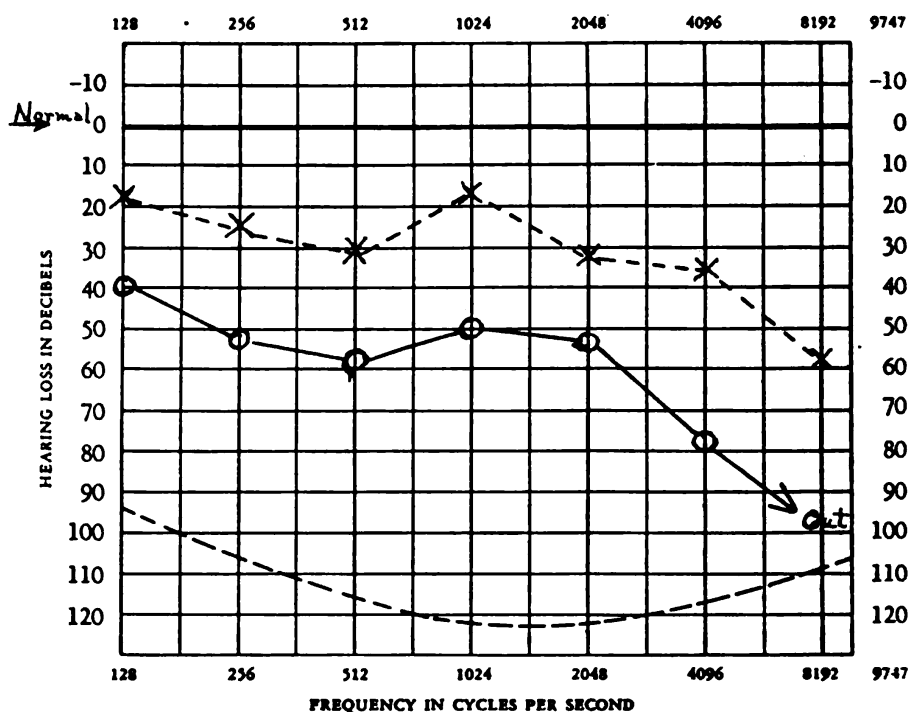
FIGURE 7.—Permanent loss "miscellaneous" diver.

E. A. C., C. T. M. Age 39 years. Seventeen years naval service. Four-inch gun fired over his station caused "ringing" and partial deafness for about 2 hours. Dropped to 90 feet by tenders—right ear bled and sometime later had "boil" in ear canal. Unable to take pressure only once and then quit diving. Right ear drum dull, scarred, retracted and thickened. Left drum dull and thickened. Watch tick right contact only, left 2/40. Whispered voice right 13/15. Otherwise normal.

most severe compressed-air illness several times and who have been exposed to high air pressure for periods of 7½ and 8 years, respectively, and yet show no general loss of auditory acuity, despite numerous complicating conditions reported in their histories. J. M. had serious difficulty in equalizing pressure once and shows a char-

acteristic loss in frequencies 4,096 and 8,192. The two cases here presented still have serviceable hearing far better than most authors lead one to suspect would result from compressed-air illness such as these men have experienced, to say nothing of their long and oft-repeated exposures to compressed air up to and including 10 atmospheres. We also have other audiograms in our series of divers who have had extensive pressure exposure and whose audiograms approximate the normal throughout. These are included in table 2 and figure 4.

The extensive report of Keays (7) substantiates our contention
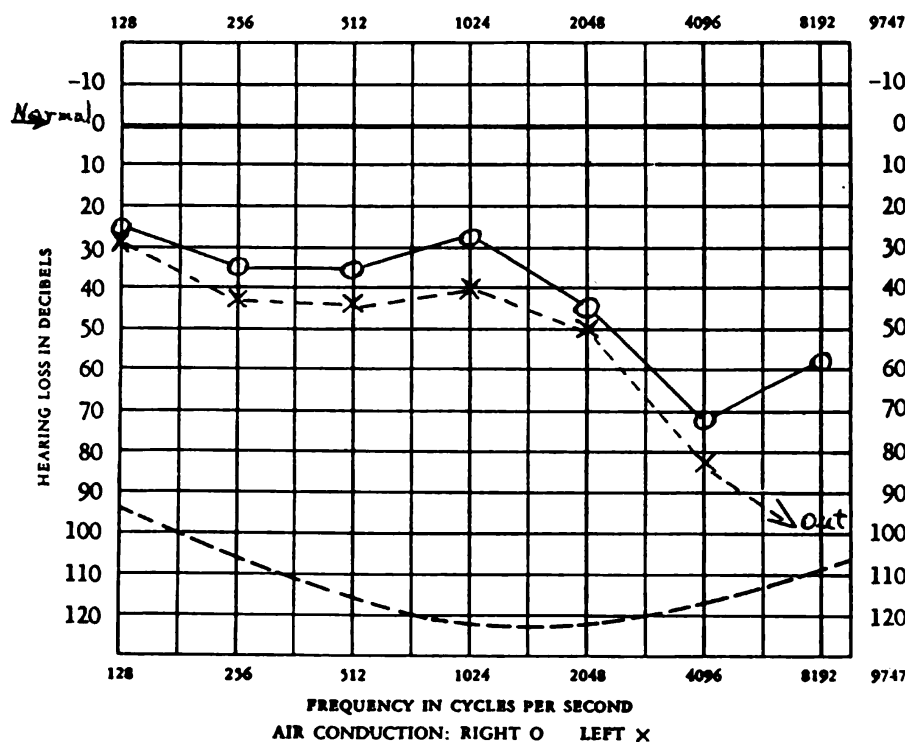
FIGURE 8.—Permanent loss "miscellaneous" diver.

J. G. N., C. T. M. Age 44 years. Twenty-five years naval service. Ten years diving duty. No submarine service. Father partially deaf at age 43. Dropped by tenders to bottom too rapidly causing rupture left ear drum—bled freely and afterward became infected. Some drainage for several years. Noted some deafness for past several years. Both ear drums dull and retracted. Left scarred. Romberg—slight sway. Weber lateralizes to the right. Watch tick right 5/40, left contact only. Whispered voice right 7/15, left 1/15. Spoken voice right 10/15, left 5/15. Coin click right 20/20, left 2/20. Physical examination otherwise negative.

that compressed-air illness rarely is responsible for deafness for in 3,692 cases of "caisson illness" vertigo without other symptoms was noted in 113, pain in the ears, hemorrhages from them and temporary deafness in 68 (aero-otitis media), Meniere's syndrome symptom-
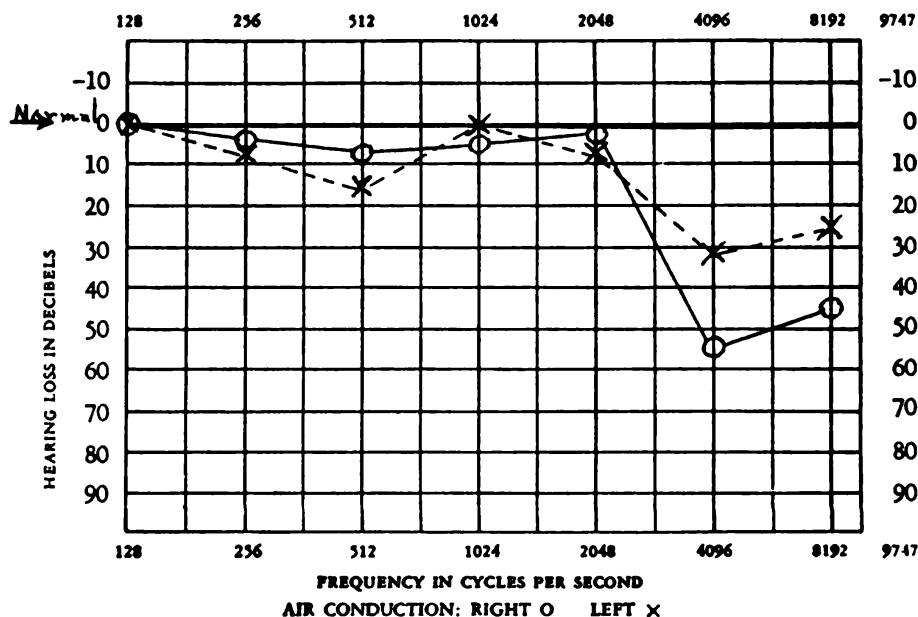
FIGURE 9.—Permanent loss (compressed-air illness) diver.

J. M., C. T. M. Age 29 years. Twelve years naval service. Ninety months diving duty. No submarine service. (Twenty-four months instructor in "Lung" training included in diving duty.) Deafened for a few minutes several times from gunfire. Difficulty in taking pressure only once. Abscess—left ear, ruptured spontaneously, no treatment. Compressed-air illness of a severe nature several times. Left ear dull and slightly retracted. Watch tick right 12/40, left 16/40. Examination otherwise negative.
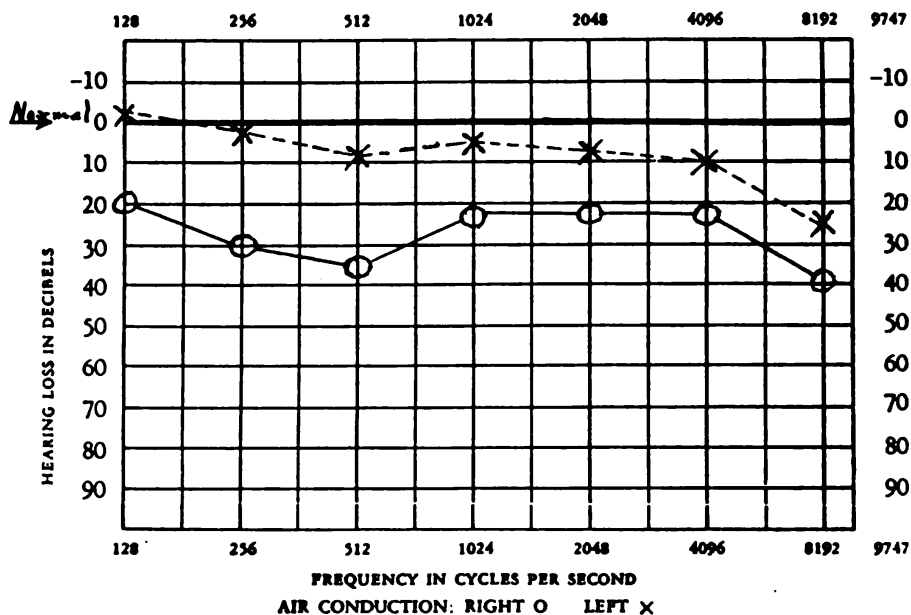
FIGURE 10.—Permanent loss (compressed-air illness) diver.

O. L. C., C. B. M. Age 37 years. Seventeen years naval service. Ninety-six months diving duty. No submarine service. (Twenty-four months "Lung" training instructor included in diving duty.) Deafened for 20–30 minutes several times from gunfire. Grandmother deaf in old age. Had compressed-air illness of a severe nature several times. Both ear drums normal. Watch tick right 20/40, left 20/40. Examination otherwise negative.

complex in 14 and apoplectiform deafness in but 2 cases. Thus at the most but 16 cases out of 3,692 can be counted as having suffered loss of hearing due to compressed-air illness.

A report from the United States Navy experimental diving unit, (26) presented 46 cases of experimentally produced compressed-air illness in which every factor was completely studied and controlled. In this group there were no 2 cases alike and yet not 1 single case complained of or developed any loss of auditory acuity. This is not a large series but if deafness were such a common complication at least 1 case would be expected to occur.

The conclusion is inevitable that whereas deafness may result from compressed-air illness it is an extremely rare occurrence. It is also certain that exposure to compressed air in itself does not adversely affect the hearing. In other words most of the deafness found to be associated with work under compressed air is due to damage to the ears because of failure to properly equalize air pressure in the middle ear—aero-otitis media.

SUMMARY

Data have been presented showing acute loss of auditory acuity associated with aero-otitis media.

Exposure to air pressure, in itself, was shown to have little, if any, effect in producing loss of auditory acuity.

Compressed-air illness was shown to be a rare cause of loss of auditory acuity.

The positive relationship between loss of auditory acuity due to damage to the ears of divers during exposure to high pressure air and the same type of damage to aviators during too rapid return to atmospheric pressure from a rarified atmosphere was suggested.

The importance of great care in the physical examination and of proper instruction of the men prior to the "taking of pressure" was stressed.

Further studies concerning naval hazards to hearing are in progress and will be presented as the work is completed.

To be continued

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CLINICAL NOTES

THROMBOSIS OF THE AXILLARY VEIN CAUSED BY STRAIN OR EFFORT

REPORT OF A CASE OCCURRING IN A DEEP-SEA DIVER; AND A BRIEF RÉSUMÉ OF THE SUBJECT

By Commander H. A. Keener, Medical Corps, United States Navy; Lieutenant T. J. Canty, Medical Corps, United States Navy, and Lieutenant J. V. Prevost, Medical Corps, United States Navy

About 10 percent of thrombosis in the blood vessels of the extremities occurs in the arms. The majority of these thrombi in the vessels of the arms are secondary to vascular lesions elsewhere in the body or are caused by direct trauma to the veins and arteries themselves. Thrombosis of the axillary vein, as a result of strain or effort, is comparatively rare. This curious lesion of the axillary vein was first described by Schrötter (1), a German writer, in 1884. Over a hundred cases have been recorded in the German, French, English, and American literature since that time (2). This is a report of a case of thrombosis of the axillary vein occurring in a deep-sea diver and a brief résumé of the subject.

CASE REPORT

M. D. E., machinist's mate, second class, United States Navy, is a robust, young, white American, 29 years old, who enlisted in the Navy in 1933. He is considered an experienced but not an expert diver, and has made about 20 dives since 1936. During one of his early dives, he accidentally closed the exhaust valve[1] on the helmet, by which a diver increases or decreases his buoyancy by controlling the volume of air within the diving suit. This caused him to be blown to the surface and, since that experience, he has been reluctant to adjust this valve for fear of repeating his mistake.

On September 19, 1941, the patient, wearing a standard Navy diving suit,[2]

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[1] When the exhaust valve is accidentally closed the diving suit completely inflates, causing the arms to be forcibly abducted to 90°. When this has happened it is impossible to reach the external exhaust control valve by hand and consequently the diver is "blown" to the surface, due to the buoyancy of the overinflated suit. However, if the diver has the presence of mind and remains cool he can open an emergency exhaust valve within the helmet by bumping it with his chin. This "dumps" all of the air from his suit and allows him to readjust the exhaust valve.

[2] The standard Navy diving suit is the same the world over. It consists of a rigid metal helmet weighing 30 pounds which rests on the shoulders and chest and encloses the head and neck. Submerged, the weight of the helmet is lifted from the shoulders and chest because of its buoyancy. The body and extremities are covered by a one-piece rubber suit with a metal collar, to which the helmet is secured. The suit and collar weigh 17 pounds. Lead shoes weighing 20 pounds apiece are worn to keep the diver in an upright position and a lead belt of variable weight, depending upon the depth of the dive, is worn about the waist. At 43 feet a 30-pound belt is required. The total weight of the suit in the dive described was 117 pounds.

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undertook a practice dive to a depth of 43 feet [a] in semitropical waters. His descent took 2 minutes. He remained on the bottom 8 minutes and ascended to the surface in 2 minutes.[4] During this dive he did not adjust his exhaust valve, so that his diving suit remained deflated. This exposed his body to the sea pressure and the lack of buoyancy made it necessary for him to use more effort in his movements. While on the bottom, he thought that he was not getting enough air, felt himself breathing heavily, and upon one occasion he called for more air. The patient stated that it required great effort to move about on the bottom and an especially great effort to pull himself up the ascending line, hand over hand. Upon completion of the dive he experienced no unusual symptoms.

Two days later he noted, for the first time, slight swelling and a bluish discoloration of the left arm. During the next 3 days, this became progressively worse, and on September 24, 1941, he reported to the medical officer complaining of moderate discomfort, swelling, limited mobility due to the swelling, bluish discoloration of the entire left arm, and prominent veins upon the upper left chest wall. He denied recent injury and related his present symptoms to his recent dive. His past medical history and family history were negative. His temperature, upon admission, was 98.8° F., and remained normal throughout the course of his illness.

The physical examination showed him to be a well proportioned, nourished, and developed young man, 5 feet 4¾ inches in height, and 141 pounds in weight. The skin of the left arm and shoulder was bluish-purple in color. The superficial veins of the pectoral region of the left chest wall and the left arm were prominently distended (see figure 1). These veins failed to collapse when the arm was raised above the level of the shoulder. The left arm was moderately swollen with a firm brawny edema. The skin of the left arm was slightly cooler and more moist than that of the right. The comparative circumferences of the two arms were as follows:

	Right arm	Left arm
Biceps	12 inches	15½ inches.
Elbow	10½ inches	11¾ inches.
Forearm	10¾ inches	12½ inches.
Wrist	7 inches	7½ inches.

There was a limitation of abduction and extension of the involved arm due to the edema. The patient is right-handed, but the grip of the left hand was slightly weaker than normally might be expected in a right-handed individual. The brachial and radial pulses, and the blood pressure were equal in both arms, the latter being 110/70. There was slight tenderness in the upper third of the left axillary fossa and a palpable cord traversing this area was not present in the right axilla. No other positive physical findings were observed.

The total and differential blood counts, the blood sedimentation rate, and the blood clotting and bleeding times were normal. The blood Kahn test was negative. X-ray of the chest showed no evidence of pulmonary disease and the heart measurements were normal. X-ray of the cervical vertebrae and left

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[a] A depth of 43 feet of water (21.1 lb. sea pressure; 35.8 lb. absolute pressure) does not require a diving suit. Many divers can work easily at a depth of 40 to 45 feet wearing just an emergency diving helmet.

[4] These time intervals are included as a matter of record. They are well within the limits of standard diving practice, which allows 1½ minutes each to descend and ascend and 1 hour on the bottom at this depth.
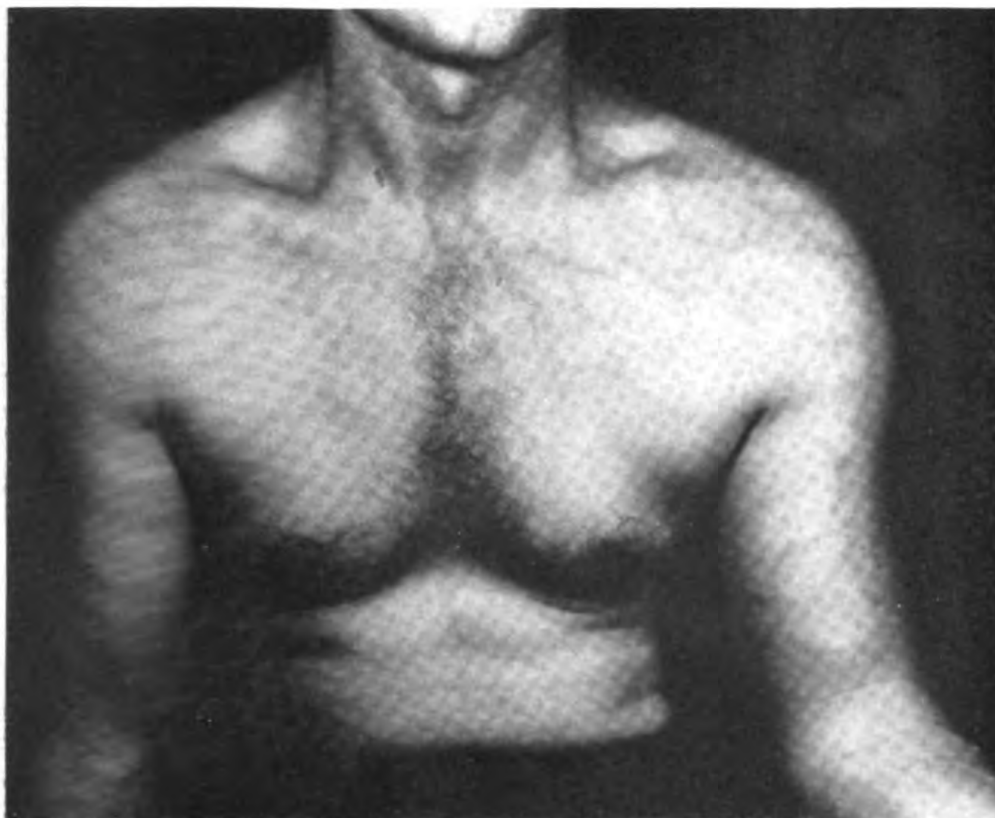
FIGURE 1.—INFRARED PHOTOGRAPH ILLUSTRATING DISTENTION AND CONGES-
TION OF THE VEINS AND SWELLING OF THE LEFT ARM.

shoulder girdle showed no evidence of any skeletal abnormalities or soft-tissue lesions. The oscillometric readings on both arms were as follows:

	Right	Left
Upper arm at 110 mm. Hg	Plus 3.0	Plus 2.5.
Forearm at 100 mm. Hg	Plus 1.5	Plus 1.0.

The patient was placed on "light duty status" but was allowed necessary use of the arm for ordinary movements not involved in work. After 2 weeks had elapsed, daily short wave thereapy over the left shoulder and chest was instituted and an "elastic bandage" was applied to the arm. In the course of 3 weeks, the swelling slightly diminished, the cyanosis gave way to lividity, and the discomfort disappeared. He continued to have tenderness along the course of the firm cord in the axillary fossa. The blood pressure in both arms remained the same. The superficial veins remained prominent, and distended upon use of the arm or upon pressure over the delto-pectoral groove. Two months after the injury he began to show definite improvement. Gradually the superficial veins of the upper left chest and arms diminished in size and became less prominent. The lividity and edema entirely disappeared. At no time had he shown evidence of a local inflammatory reaction or symptoms of constitutional disease.

He was allowed to resume unrestricted activity, but was physically disqualified for diving duty, and advised to favor his left arm.

DISCUSSION

Thrombosis in the axillary vein caused by effort or strain is a definite clinical entity. It has frequently been the subject of compensation disputes because of the trivial circumstances under which it is often acquired. A short résumé of the subject is included in this case report for those readers unfamiliar with this interesting injury.

"Effort thrombosis" usually occurs in young or middle-aged, well developed, healthy individuals. It is predominantly seen in males, the ratio being 4 to 1, and the right arm is affected about twice as frequently as the left arm (3). When the latter is involved, the patient is almost always left-handed, or has strained the left arm under circumstances which called for extra effort in its use.

Various theories have been advanced as to the cause of primary axillary vein thrombosis but the etiology and pathology remain obscure. The factors of age, sex, and arm affected support the theory of trauma. Lowenstein (4) demonstrated, in cadavers, that abduction and extension of the arm in many individuals will cause the costocoracoid ligament and subclavius muscle to indent the axillary vein as much as 3 millimeters. He believed this caused distention of the vein with subsequent rupture of the vessel wall and thrombosis. Gould and Patey (5) confirmed his anatomical observations, but be-

lieved that the rupture of a valve, which they demonstrated at the level of the subclavius muscle, accounted for the injury to the vessel wall. These theories most closely approximate the classical conditions predisposing to thrombus formations. Cottalorda (6) believed these lesions of the axillary vein had their origin in a venospasm induced by sympathetic irritation caused by trauma. The theory of infection has found little support. All authors agree that trauma is part of the picture, and definitely consider this lesion a compensable injury.

The diagnosis is usually self-evident. There is a history of an accidental or occupational strain, often an unusual swing or twist, an "extra effort." Immediately thereafter, or following an interval of hours or days, edematous swelling of the involved arm occurs. This swelling may be a doughy, pitting edema, but usually is firm and brawny and fairly evenly distributed over the entire arm. Intense pain may be a part of the syndrome, but often pain is absent or is simply a discomfort experienced because of the increased size of the arm. The skin is cyanotic but may be livid or will become livid as the cyanosis disappears. The superficial veins of the pectoral region, corresponding shoulder, and arm are distended and prominent. A firm tender cord is usually palpable in the axillary fossa near the lower part of the delto-pectoral groove. The blood pressure and pulse in both arms are usually the same, although occasionally there is a slight increase in the systolic tension on the affected side (7). Increased venous pressure and decreased oxygen saturation of the venous blood may be demonstrated on the affected side and confirm the existence of a venous obstruction. The body temperature remains normal or may show a very slight transitory rise. There are no signs of a local inflammatory reaction at or about the lesion. The blood picture is not unusual and in the majority of cases the total and differential blood counts remain within normal limits. The blood platelets, sedimentation rate, coagulation and bleeding times, and other values are normal. Venous stasis and the failure of the axillary vein to visualize may be demonstrated by means of intravenous radio-opaque dyes. A report by Kaplan (8) contains several good illustrations of x-rays obtained by this method.

In the differential diagnosis of thrombosis of the axillary vein due to strain or effort it is necessary to exclude: first, direct injury to the vessel; second, all extrinsic causes of venous obstruction to the vessels of the arm; third, intrinsic causes of thrombosis secondary to regional infections and injuries elsewhere in the body; and fourth, general constitutional disease with embolic or thrombotic tendencies. Without a history or evidence of strain, effort, or indirect trauma of

some sort, the diagnosis of primary axillary thrombosis is highly questionable.

The prognosis for life in these cases is excellent, but since the duration of the disability varies from 2 months to several years, the surgeon should be guarded in expressing his opinion as to the length of time the patient will be incapacitated. Relapse and recurrence occur frequently upon the slightest provocation and the patient should be cautioned to favor the involved arm.

Expectant treatment is advisable until it is certain that spontaneous recovery is going to be slow or will not take place at all. During this period, the majority of the cases are benefited by rest, elevation, and immobilization of the part. Elastic bandages and diathermy are valuable adjuncts to the above measures. In the mild cases, a comparatively rapid cure and return of function will be effected by nature in 6 to 8 weeks. In the more severe cases, a very gradual improvement is noted as the collateral circulation improves. When the condition persists, or in cases predisposed to relapse and recurrence, conservatism should be abandoned in favor of an exploration of the lesion. Rapid cures have been effected by thrombectomy, but the best results have been obtained by complete excision of the thrombotic venous segment.

CONCLUSION

It is believed that this is the first case report of primary thrombosis of the axillary vein which has resulted from deep-sea diving. The case reveals a common and dangerous practice among inexpert divers of ignoring the control of exhaust air and buoyancy because of their fear of being blown to the surface. From the information at hand, it is probable that the injury occurred when the diver was pulling himself up the ascending line. Since this maneuver requires that the maximum effort be expended when the arm is in the extreme position of abduction and extension, one may conjecture from Lowenstein's observations, that the pressure of the costocoracoid ligament is the primary etiological factor underlying this injury.

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TRAUMATIC ANEURYSM OF THE ABDOMINAL AORTA OF 27 YEARS DURATION

CASE REPORT

By Lieutenant Commander E. Ricen, Medical Corps, United States Navy, and Lieutenant, junior grade, P. F. Dickens, Jr., Medical Corps, United States Navy

We are presenting a case of traumatic aneurysm of the abdominal aorta known to have existed for 27 years, and which had been complicated by a duodenal ulcer. The diagnosis of the aneurysm was first established by an exploratory operation eleven months after the original injury in 1914, and death occurred from rupture in 1941, 27 years later. The existence of this aneurysm seemingly did not interfere with the patient's occupation as a railroad conductor and many of his interval symptoms were due to the duodenal ulcer for which a gastrojejunostomy had been performed.

Aneurysm of the abdominal aorta is relatively infrequent, forming from 7 to 10 percent of all aneurysms. The traumatic type is of rare occurrence since of all aneurysms, syphilis is the causative agent in 50 percent; and of the remaining, arteriosclerosis is the predominate etiological agent.

The most predominate feature is the excruciating boring type of pain due to erosion of the bodies of the lumbar vertebrae with pressure, not only on the spine and the dorsal roots, but also anteriorly on the celiac plexus. Other symptoms are due to the pressure of the expansile tumor or adjacent structures such as pressure on the esophagus with the production of dysphagia, on the renal vessels with oliguria, on the ureters with hydronephrosis, and on the inferior vena cava with edema of the lower extremities.

Physical signs of importance are pulsations, thrill, bruit, and a definite tumor mass with expansible pulsation that can be palpated. X-ray evidence is pathognomonic since no other condition presents
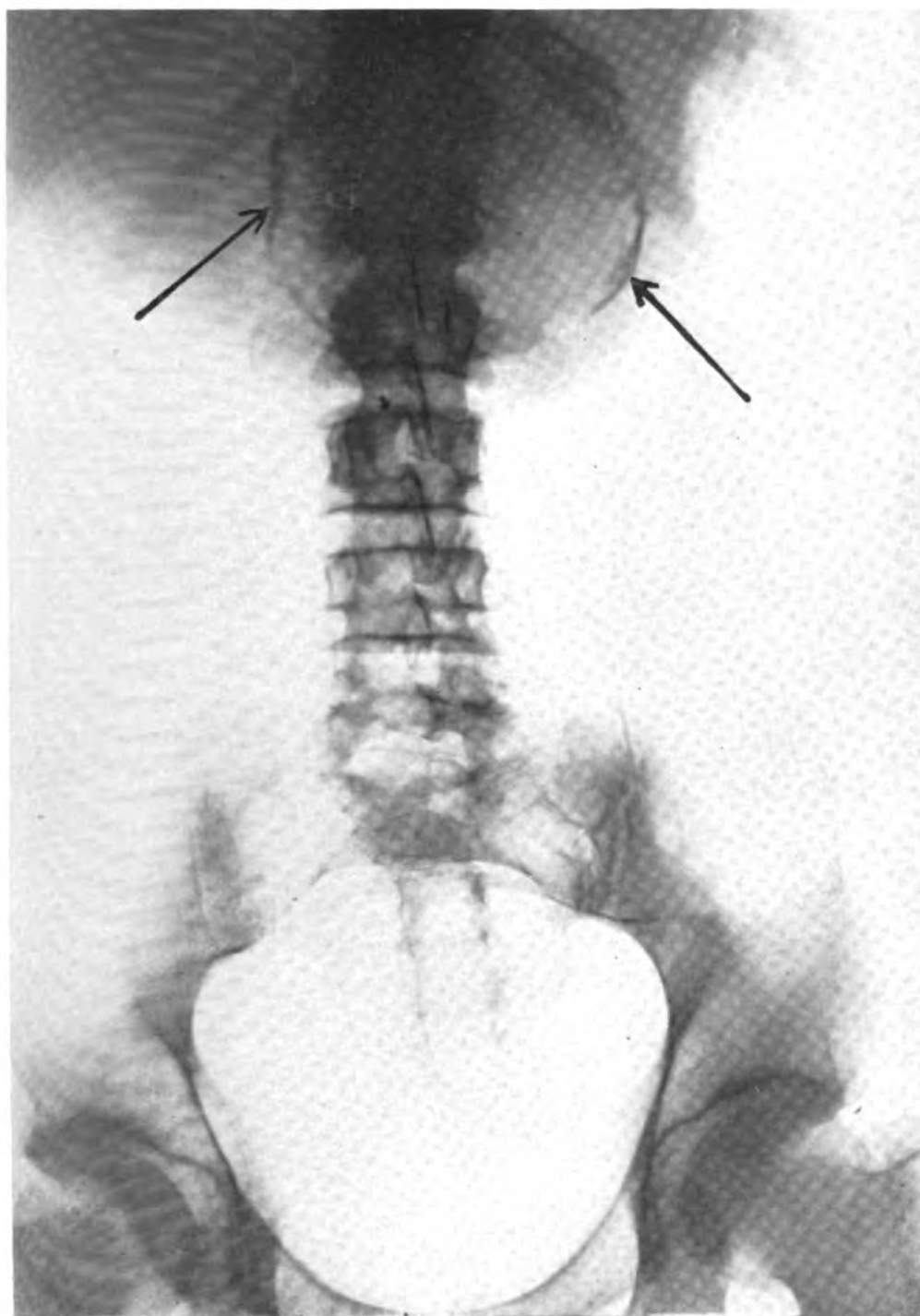
FIGURE 1.—X-RAY OF ABDOMEN SHOWING CALCIFIED WALL OF ANEURYSM.
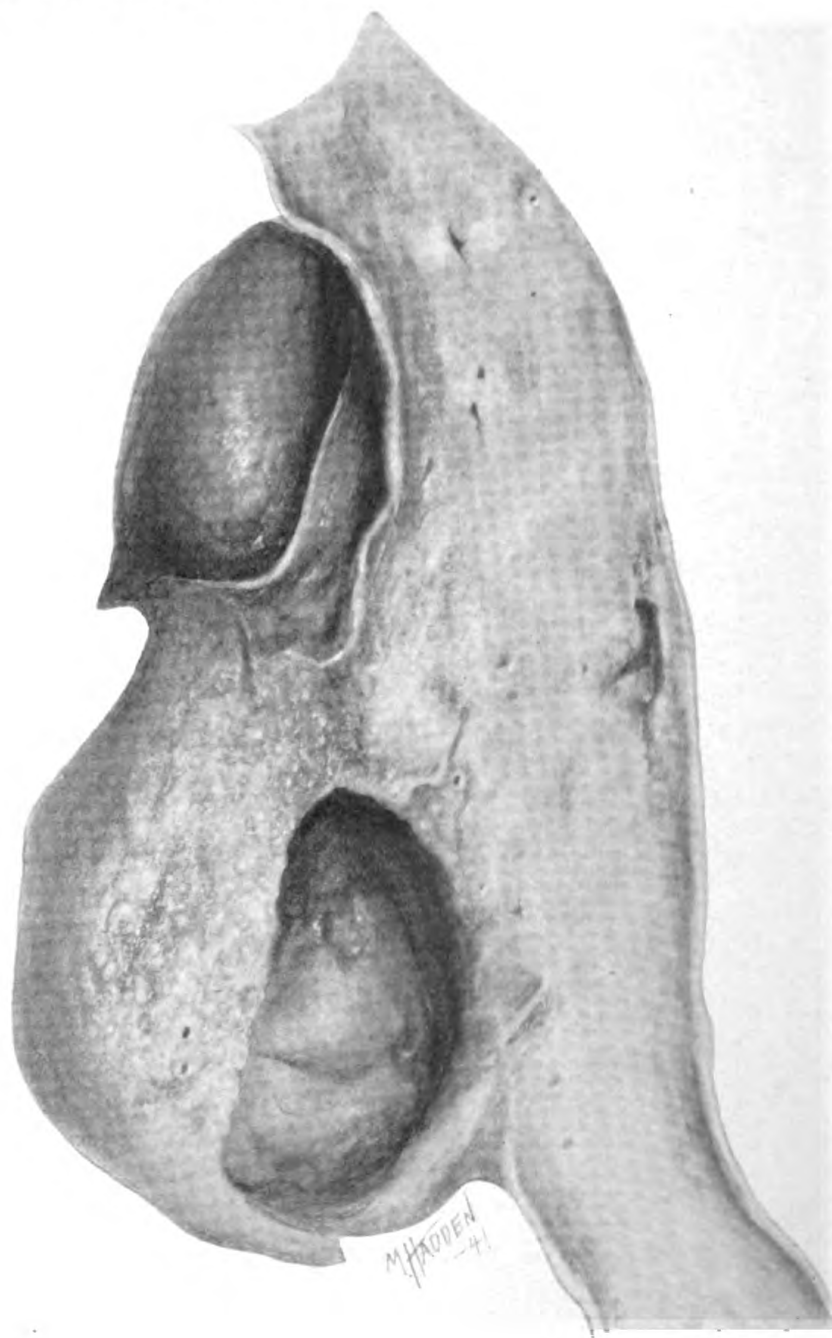
FIGURE 2.—DRAWING OF SPECIMEN SHOWING POINT OF RUPTURE.

a picture in which the intervertebral discs remain intact in the presence of erosion of the vertebral bodies.

Death due to aneurysm is usually by perforation, generally internally although it may occur externally. Aneurysm of the abdominal aorta usually ruptures into the retroperitoneal space, frequently into the duodenum, occasionally into the peritoneal cavity, and infrequently through the diaphragm.

The following case is one in which the etiological agent was trauma; syphilis being excluded by the history and the repeatedly negative Wassermann and Kahn tests over a period of years. The original injury was sustained in 1914 at the age of 21, and the patient, after being surveyed from the naval service, was able to perform work as a railroad conductor for a number of years until his last admission in 1941.

B. B. W., a 48-year-old white male, was admitted to the hospital on August 26, 1941, complaining of severe epigastric pain, knifelike in character, of 4 days' duration during which time it had become progressively more severe with radiation to both lumbar areas. Associated with this pain was slight dyspnea, weakness, and pain in both legs upon walking. For several months previous to admission he had been unable to take any nourishment other than liquids. No other symptoms referable to the gastro-intestinal tract and cardio-respiratory systems could be elicited.

The patient had rheumatic fever in 1913. In March of 1914, he was struck in the abdomen with a gun ram which caused the loss of consciousness for 10 minutes, after which he continued on duty until December of 1914 when he was hospitalized with complaint of epigastric distress. In February of 1915, an exploratory operation was performed and a diagnosis of traumatic aneurysm of the abdominal aorta was established. In 1922 he had a perforated duodenal ulcer; and in 1923 he again perforated, at which time a gastrojejunostomy was performed. In 1927 he had a severe gastric hemorrhage. In 1940 he was hospitalized with severe epigastric pain which was controlled by morphine. He was discharged in 1 week, symptom free. There was no history of venereal disease.

On examination the patient appeared to be emaciated, acutely ill, and in severe pain, with a cold, clammy skin, profuse perspiration, and a grayish color to the lips. The temperature was 101.4° F., pulse 86, and respiration 21 per minute. The lungs were clear, the heart not enlarged, there were no murmurs, and the blood pressure was 180/110. There were both old right and left recti scars on the anterior abdominal wall. The abdomen was soft with no rigidity, and was only slightly tender. In the epigastrium there was a tender round mass that was regular in shape and about the size of a small grapefruit. The outline could easily be made out. A definite pulsation synchronous with the pulse could be both seen and felt. There were also numerous varicosities of the lower extremities.

The red cell count on admission was 4 million and there was a slight leucocytosis present. An x-ray plate of the abdomen revealed a calcified aneurysm of the abdominal aorta 12.5 cm. in diameter (see figure 1) while an x-ray of the chest showed the lungs to be clear. Both the Wassermann and the Kahn tests were negative.

Large doses of morphia failed to control the severe pain; and, on the day after admission, the pain became more severe, especially in the epigastrium and along the right costal margin of the chest. Cyanosis developed and the patient coughed up a small amount of bloody sputum. Physical signs of consolidation appeared in the lower right chest and an x-ray of the chest on the next day, confirmed the physical findings. An oxygen tent calmed the patient and decreased the cyanosis, but the patient became weaker, the pulse very rapid and thready, and he expired on the fourth hospital day with signs of circulatory collapse.

Pathological examination revealed a saccular aneurysm of the abdominal aorta (see figure 2) that was 12 cm. in diameter, irregular, firm, indurated and calcified. It extended downward from the diaphragm to one-half the distance to the bifurcation of the aorta. On opening the sac, the wall was 3 to 4 cm. thick and made up of laminated clots interspersed with areas of calcification. The cavity was filled with both fresh and old degenerating blood clots and a minimum amount of fluid blood. A rupture of the aneurysmal wall was found in its upper posterior portion at the level of the diaphragm extending through the aortic hitaus into the posterior mediastinum with resultant hemorrhagic infiltration along the mediastinal structures as far as the cervical region. From the medias- tinum, a secondary rupture had occurred into the right pleural cavity in which over 500 cc. of bloody fluid were found. The right lung was completely atelectatic. The thoracic aorta was slightly dilated and showed considerable atheromatous degeneration with ulceration and calcification. The abdominal aorta below the aneurysm was constricted and relatively free from degenerative change.

The prognosis, as is well known in all aneurysms, is very poor from the time that the diagnosis is made, and it is rare for one to proceed for 27 years before rupture or intercurrent disease termi- nates life. Medical treatment is of little avail. Surgical treat- ment up to the present has not been particularly successful.

A STUDY OF DEPTH PERCEPTION AND FUSION IN RELATION TO THE TREATMENT OF STRABISMUS

By Lieutenant Commander A. W. Loy, Medical Corps, United States Navy

It is the purpose of this paper to present a report of further study in the physiology of fusion and depth perception, and its ap- plication to the treatment of strabismus.

Fusion and depth perception involve the same elements of the visual apparatus, simultaneously. At birth, the human eyes wan- der separately for a few hours, or days. They then become re- stricted to the plane of the visual axes. The eyes continue to diverge and converge in that plane, but there is no vertical deviation of one eye from that plane.

The macula of the retina contains the greater number of reacting units, and it develops the highest visual acuity. When a light ray falls upon the retina, there is a forceful effort, controlled by reflexes, to place the eye in a position to receive the stimulus on

the macula. The process raises the stimulus to the level of consciousness, and establishes the condition of fixation. Accommodation affords distinct imagery, which adds force to the stimulus. Each eye is thus individually controlled. When the two eyes receive stimuli from the same light point, fixation and distinct imagery initiate the process of association and fusion of the two images in the perception area. Thus we find a chain of events, stimulation, accommodation, and the clasping link of fusion to establish the coordination of the eyes for single binocular vision.

With the eyes fixed upon a given point, the two images (on the maculae) fall upon a line corresponding to the intersections of the plane of the visual axis with the two retinae. Retinal units dispersed along this line define corresponding retinal zones, in which are found the images of the given point (in this case, on the maculae).

A second point, in the same plane, will form images in the same corresponding retinal zones. If the second point is brought nearer, in the same plane, the images on the retinae remain in the corresponding retinal zones, but they will be more widely separated, in the zones, than are the images of the point of fixation (the maculae). Likewise, if the second point is moved to a greater distance in the same plane, the images in the corresponding retinal zones will be less widely separated than the images of the point of fixation (the maculae).

As the second point is moved nearer, or farther, than the point of fixation—that is, within or without the horopter—diplopia does not occur as previously taught. Within certain limits, there is fusion. There is a consciousness of three types of fusion which are as distinct as the difference in sensations of pain, heat, and cold. This is the physiological basis for depth perception. If a point outside the plane of the visual axis forms images on the two retinae, a line drawn across the retina through these images will form corresponding retinal zones for that point. Those zones will be parallel to the zones passing through the maculae.

The conditions, as set forth above, hold true for any point outside the plane of the visual axis. Furthermore, it is true for all points in space. There is, therefore, a parallelism of zones in the development of the visual functions of the retinae.

Single vision and depth perception depend upon fusion. There are three types of fusion:

1. Images on corresponding retinal areas.

2. Images on noncorresponding retinal areas, which are more widely separated than corresponding retinal areas.

3. Images on noncorresponding retinal areas, which are less widely separated than corresponding retinal areas.

Because of the parallelism of retinal zones, only retinal areas in corresponding retinal zones are associated in fusion. This condition of parallelism is readily demonstrated by the stereophorometer.

Within the corresponding parallel zones of the retina lies the mechanism for the different types of fusion which provides extension of fusion outside corresponding retinal areas. This extension of fusion provides a "fusion faculty reserve," which aids in the earlier stages of the fusion learning process.

Strabismus in children is usually caused by interference with one of the coordinating factors described above. The nerve pathways, the motor system, and the sensory units, are usually normal and should not be disturbed. Their normal development follows proper stimulation. Faulty stimulation may be due to refractive error, and refraction is indicated. This is the largest group. In the second group, there is clinical evidence of a higher resistance to the passage of impulses, and an increase in stimulation is indicated.

The treatment, therefore, is directed toward the production of stimulation, good as to quality, and sufficient in amount. By the use of the screen, vision is limited to one eye, resulting in increased stimulation to that eye. Distinct imagery elicits fixation and a simple neuromuscular coordination for the individual eye. After a period of stimulation, when both eyes are exposed to the same light points, and as both eyes attempt fixation, they assume the geometrical position, as described above, to receive the images on the maculae. Fusion follows automatically. The resulting perception is comparable to that of heat, cold, pain, and joint-muscle sensation. Case reports follow.

CASE REPORTS

Group 1

Interference with visual acuity, with poor stimulation, due to indistinct imagery.

Case 1.—4-20-38.—R. A., age 16 months. Myopia, high degree. Constant internal strabismus. Searching type nystagmus. Retardation in development, lack of coordination of muscle groups, and equinovalgus, bilateral.

Refraction: O. D. minus 6.00 S minus 1.50 C ax 135; O. S. minus 6.00 S minus 1.50 C ax 45.

The above prescription was given, with a screen to one eye, alternating, daily.

5-7-38.—Early fixation of individual eye noted. Squint reduced to approximately 30 degrees. Coordination of muscle groups noted.

6-16-38.—Monocular fixation much improved. Child beginning to walk and to talk. Early attempts to coordinate hand and eye.

12-20-38.—Strabismus reduced to the intermittent type, small in amount. Marked improvement in general development. Alternating screen used only during the morning hours.

9-30-39.—Strabismus seldom appears. Nystagmus is greatly reduced. General condition shows marked improvement.

5–17–40.—Increase in strabismus, internal, right eye. There is cataract, bilaterally.

6–10–40.—Cycloplegic for examination of the eyes. The rapid development of cataracts interferes with retinoscopic and ophthalmoscopic examination. It is noted that with the pupils dilated, there is improvement of vision, better fixation, and relief from the strabismus in the right eye.

Case 2.—*3–9–39.*—M. B.; age 4 years. Myopic astigmatism. Intermittent, left strabismus and hypertropia.

Severe illness of several months followed by the above condition.

Refraction: O. D. minus 1.50 C ax 180; O. S. minus 1.50 C ax 180.

Screen, alternating, morning hours, only.

9–30–39.—Complete relief from strabismus.

Case 3.—*11–11–39.*—L. F.; age 6 years. Hyperopia, hyperopic astigmatism, with excessive accommodative effort and its associated convergent effort. Internal strabismus, alternating, intermittent. Began at age 10 months, and became worse on entering kindergarten.

Refraction: O. D. plus 2.00 S plus 1.00 C ax 90; O. S. plus 2.00 S plus 1.00 C ax 90.

Daily alternating screen.

12–6–39.—Mother states that there has been no recurrence with the lenses. Screen discontinued.

4–6–40.—Complete relief from strabismus.

Case 4.—*8–5–39.*—G. W.; age 7 years. High degree hyperopia, with excessive accommodation and excessive convergence. Internal strabismus, right, constant. Began at age 5 years. Right amblyopia.

Refraction: O. D. plus 4.50 S plus 0.50 C ax 90 20/50; O. S. plus 4.50 S plus 0.50 C ax 90 20/20.

Alternating screen daily.

12–20–39.—Complete relief from strabismus, with the lenses.

3–2–40.—No strabismus. V. O. D. 20/30; V. O. S. 20/20.

Note improvement in amblyopia.

Continuation of the screen to left eye during play periods is indicated.

Case 5.—*1–26–39.*—B. M.; age 5 years. Marked right internal strabismus, constant. Began at age 4 years.

Refraction: O. D. plus 2.75 S; O. S. plus 2.25 S plus 0.25 C ax 180.

Screen for left eye, constant.

2–5–40.—Intermittent type strabismus, alternating. Alternating screen, daily.

2–29–40.—No strabismus for ordinary vision. Slight strabismus for near fixation. Continue alternating screen.

4–12–40.—Complete relief from strabismus. Discontinued screen.

Case 6.—*7–8–38.*—V. F.; age 5 years. Internal strabismus, alternating, intermittent. Becomes worse for near fixation. Began at age 3 years, and became worse on entering kindergarten.

Refraction: O. D. plus 4.00 S plus 1.25 C ax 90; O. S. plus 4.50 S plus 1.25 C ax 90.

No screen.

8–21–39.—There has been no recurrence of strabismus after a 2-month period following the prescribing of lenses.

Case 7.—*3–18–38.*—D. F.; age 5 years. Internal strabismus, right, intermittent. Worse for near fixation. Began at age 2 years.

Refraction: O. D. plus 1.50 S plus 0.50 C ax 75; O. S. plus 1.00 S plus 0.50 C ax 105.

No screen.

5–5–38.—No strabismus with lenses.

4–8–40.—Complete relief from strabismus.

Case 8.—*5–11–40.*—J. S.; age 6 months. Marked internal strabismus, constant. Began at age 4 months.

Refraction: O. D. plus 0.75 S plus 1.00 C ax 180; O. S. plus 0.75 S plus 1.00 C ax 180.

Alternating screen, daily.

6–3–40.—Eyes remain straight for long intervals, showing a change to the intermittent type. The degree of strabismus is much reduced.

Case 9.—*11–17–39.*—L. P.; age 7 years. Internal strabismus, right, intermittent.

Refraction: O. D. plus 2.00 S. 8/20; O. S. plus 1.00 S. plus 0.50 C ax 90 20/20. Screen for left eye during play periods.

1–27–40.—V. O. D. 18/20; V. O. S. 20/20. Continuous screen.

4–6–40.—V. O. D. 20/20; V. O. S. 20/20. Discontinue screen.

Group 2

This group has always been called the problem group. There is clinical evidence that increase in stimulation is necessary to overcome resistance to impulses.

Case 1.—*4–22–40.*—W. W.; age 14 months. Marked left internal strabismus, constant. Onset, sudden, 3 weeks previously, and constant since onset. No symptoms preceded onset. Atropine for refraction.

4–29–40.—Refraction: O. D. plus 0.75 S.; O. S. plus 0.75 S.

Screen for right eye, constantly.

5–6–40.—Intermittent strabismus, left eye. Continue screen for right eye.

5–13–40.—Eyes straight for long intervals. Alternate screen, daily.

6–3–40.—No strabismus. Continue alternating screen.

6–10–40.—No recurrence of strabismus. Alternating screen daily, during the morning only.

SUMMARY

The geometrical conditions under which binocular vision develops results in the establishment of a pattern of retinal zones parallel to the plane of the visual axes. Only those retinal units in the right and left parts of the same parallel zone are associated in fusion. Noncorresponding retinal units as well as corresponding retinal units in the same parallel zone are associated in fusion. There are three types of fusion which form the physiological basis for binocular depth perception.

Fusion is the clasping link in a chain of events which establishes binocular coordination. Fusion follows stimulation (under certain geometrical conditions) just as sensations of pain, heat, and cold, follow stimulation.

Strabismus in children is due to the interference with the proper stimulation of the sensory elements. The treatment is, therefore, directed toward the proper stimulation of the retinal units. It may be reduced to simple procedures.

The great secret to the success in the treatment of these cases lies in early treatment. This holds true for cases that have had fusion and suddenly develop a stabismus after 3, 4, or 5 years of age.

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A CASE OF PNEUMOCOCCIC MENINGITIS TYPE X

By Lieutenant Commander Joseph Palma, Medical Corps, United States Naval Reserve

CASE REPORT

The patient, P. J. D., machinist's mate, second class, 21 years old, was admitted to the hospital on July 7, 1941, in a comatose state with a temperature of 101°, pulse rate 65, respiration 78 per minute, and a blood pressure of 118/60. He was stuporous and disoriented but would arouse at intervals and fight restraint. If left alone, his position was one of flexion in all joints, except the neck, which was held rigidly. The head was cupped in the right hand. The positive findings were the neck rigidity, spastic extremities, and moderate injections of the right ear drum. There were no contusions or lacerations about the head or face.

The accompanying health record stated that there had been some headache and deafness in the right ear for 2 days prior to admission following a fall in a motor launch in which the right side of the head had been struck sharply against the gunwale. There was no history on admission and none could be obtained subsequently of a preceding cold or earache.

The hemoglobin was 14.5 gm. The erythrocytes numbered 4,390,000 and the leukocytes 26,700 per cmm. of blood; 95 percent of the leukocytes were neutrophiles. The cerebrospinal fluid was not increased in pressure, contained 6,500 leukocytes per cmm., and was positive on typing and culture for diplococcus pneumoniae type X. Culture of the blood was also positive for the same organism.

X-ray films of the skull, stereoscopic antero-posterior, lateral, and other views from various angles revealed a linear fracture in the right occipital bone extending from the superior nuchal line (approximately 4 cm. from the midline) inferiorly and through the posterior condyloid canal, then medially and into the foramen magnum. It could not be demonstrated that this fracture involved the right petrous pyramid or roof of the nose (cribiform plate). At time of discharge, the fracture line showed beginning union. Repeated x-ray films of both mastoids were negative for evidence of pathology.

There was no evidence of middle ear disease, other than the very moderate injection of the right drum, noted on admission.

Sulfapyridine totaling 274 gm. (by the oral route and the soluble sodium salt intravenously) was administered during the first 30 days of the illness. A change was then made to sulfathiazole because of the increasing toxic effect of the drug on the hematopoietic system. Three hundred and thirty-seven gm. of this sulfonamide was administered orally during the second 30 days, making a grand total of 611 gm. of sulfonamides administered during the 60 days.

Treatment was energetically begun with 14 gm. of sulfapyridine by mouth and 6 gm. of the soluble sodium salt by vein in the first 24 hours of illness, followed by a daily maintenance dose of 12 gm. The symptoms disappeared rapidly and by the fourth day of illness the patient was rational and the blood and cerebrospinal fluid were sterile of organisms, and remained sterile. On the tenth day gradual withdrawal of the drug was begun. The fifteenth day saw a second appearance of the signs and symptoms of meningitis with a positive spinal fluid. Sulfapyridine treatment comparable to that employed at the onset of the disease was again instituted. The same favorable sequence of events occurred and on the twenty-fifth day of illness gradual withdrawal of the drug was attempted for the second time.

On this day the cerebrospinal fluid was reported as sterile. On the twenty-ninth day a third attack of the infection occurred with a return of a positive spinal fluid and sulfonamide therapy identical with the previous two attempts was begun. On the thirtieth day transition to sulfathiazole therapy was successfully accomplished and a daily maintenance dose of 12 gm. established. This time, however, the cerebrospinal fluid did not become sterile of organisms. Specific antisera was not available until the forty-seventh day when 80,000 units of type X antipneumococcic rabbit serum was administered intravenously followed by 40,000 units more on the forty-eighth day. The cerebrospinal fluid promptly became sterile of organisms on the forty-ninth day and remained sterile. Withdrawal of the drug was begun again on the fifty-seventh day and completed on the sixtieth. The patient remained free of the signs and symptoms of meningitis and was regarded as cured. He was transferred to a United States naval hospital for final disposition after 102 sick days free of the symptoms of meningitis. The only sequella was the eighth nerve deafness, and that had improved.

The concentration of the drug in the blood was maintained at 8–10 mg. percent with sulfapyridine and at 6–8 percent mg. with sulfathiazole therapy. The spinal fluid sulfapyradine varied between 5–6 mg. percent, while the sulfathiazole level of concentration was only 1.5–2 mg. percent, as was to be expected.

Five transfusions of whole citrated blood were given during the month of sulfapyridine administration. Indications were a fall in hemoglobin below 10.5 gm. and a decrease in the number of erythrocytes below 3,750,000 per cubic millimeter.

Sufficient fluids were given enterally and parenterially to keep the daily output of urine at no less than 1,500 cc.

COMMENT

1. A case of pneumococcic meningitis, type X, with recovery is reported.

2. A total amount of 611 gm. of sulfonamides, 274 gms. of sulfapyridine and 337 gm. of sulfathiazole was administered to the patient during the 60-day period.

3. A maximum amount of 20 gm. of sulfapyridine in 24 hours was given on three occasions.

4. The value of sulfonamide therapy with type-specific antiserum is supported.

5. The portal of entry of the infection could not be demonstrated.

6. The danger of the development of anuria during the course of treatment was apparently circumvented by the administration of fluids in sufficient amount to produce an output of at least 1,500 cc. daily.

CHOLEDOCHODUODENOSTOMY VERSUS CHOLECYSTENTEROSTOMY

By Lieutenant E. M. Wade, Medical Corps, United States Navy

When confronted with a case of chronic biliary stasis in a young patient the physician usually is dealing with a case of catarrhal cholangitis which tends to subside regardless of what treatment is offered. In older patients, chronic biliary stasis may be due to malignancy of the head of the pancreas or bile ducts, impacted hepatic or common duct calculi, chronic pancreatitis, or stricture of the common duct following injury during previously performed abdominal surgery, or perhaps due to the passage of stones, plus the effects of infection, and other causes. Straus and his associates (1) feel that jaundice is frequently due to an inflammatory process that begins as a duodenitis which ascends the pancreatic and common ducts. This triangular infection is held to cause hypertrophy of the papilla of Vater, which in turn gives rise to spasm and obstruction of the common duct, biliary stasis and ultimately a breaking down of the liver cells and cirrhosis.

Patients that present the picture of chronic biliary stasis due to a cause other than catarrhal cholangitis should be given the benefit of laparotomy (1) (2) (3). If the obstruction is found to be due to a calculus in the common duct, removal of the stone followed by external drainage of the biliary tract is attended by gratifying results in many cases. In cases, however, where it is impracticable for any cause to actually remove the obstructive lesion encountered, as some congenital or acquired strictures, carcinoma of the head of the pancreas, chronic pancreatitis, and certain calculi in the retroduodenal portion of the common duct, anastomosis of the distended portion of the biliary tract to the gastro-intestinal canal produces a short-circuit of bile with relief of jaundice. If the obstruction is benign or inflammatory, permanently beneficial results should be obtained. If due to pancreatic or bile duct malignancy, the jaundice and itchings are relieved, although the patient eventually succumbs to the effects of the new growth (3) (4).

In reviewing their experience with the surgical anastomosis between the biliary tracts of children for relief of obstructive jaundice, Ladd and Gross (5) found choledochoduodenostomy to be the operation of choice.

To von Winiwarter is given credit for the first biliary-intestinal tract anastomosis, which was performed in 1882 (3). In his case the gallbladder was anastomosed with the colon. Shortly thereafter the duodenum and the stomach were suggested and used, because of the certainty of an ascending infection of the bile ducts and liver from the colon. In 1888 Reidel devised a choledochoduodenostomy for the relief of idiopathic dilitation of the common duct, the so-called choledochus cyst. The patient, however, died of a bile peritonitis (3). To Sprengel, in 1891, belongs credit for the first reported successful anastomosis between the common duct and the duodenum. Subsequent to this early work in this field, later and contemporary surgeons as Jacobson, W. J. Mayo, Novnihan, Walton, Sullivan, MacArthur, and others have made valuable contributions.

In the presence of an irremovable obstruction in the terminal portion of the common bile duct, simple anastomosis of the dilated common duct with the duodenum appears to be the most satisfactory operation. Indeed, if the gallbladder has not already been removed, the presence of calculi and infection coincident with the chronic biliary stasis invariably present indications for cholecystectomy in addition to choledochoduodenostomy. Once a gallblader becomes infected, its progress toward marked pathology is rarely altered (6). This tendency to progression appears to be aggravated following the anastomosis of the gallbladder to various portions of the intestinal tract, as experience has shown the walls of the gallbladder to become greatly thickened as a result of chronic inflammation, with closure of the stoma and recurrence of biliary obstruction in many cases. A case of common bile duct obstruction following trauma during pyloroplasty, and for whih two unsuccessful anastomoses between the gallbladder and stomach were performed, is hereinafter reported. Relief was obtained by simultaneously removing the infected gallbladder and performing an anastomosis between the duodenum and the dilated common duct. Nassau (7) reported a case of cholecystoduodenostomy in which the stoma became obstructed by the formation of an extremely large gallstone. Finister (8) recently spoke before the Vienna Medical Society in connection with a series of 70 cases of choledocholithiasis in which he removed the gallbladder followed by choledochoduodenostomy, with an operative mortality of 7 percent. Of 42 patients followed from 3 to 12 years, 88 percent were well. In removing the gallbladders, he believed that the formation of additional stones and subsequent obstruction were prevented.

Straus (1) and his associates advocate choledochoduodenostomy followed by a posterior gastro-enterostomy in cases that suffer with an irremovable obstruction of the common duct. The gastro-enterostomy is performed because "it prevents the regurgitation of food through

the anastomosis between the common duct and the duodenum, and puts the triangle of the duodenum, pancreas, and hepatic ducts at rest." The use of gastro-enterostomy for this purpose has been considered by others, with and without pyloric exclusion, but there does not appear to be a unanimity of opinion regarding the merits of this additional procedure.

Prolonged external drainage of the common bile duct by means of a T-tube has been advocated by some in cases of inflammatory obstruction of the terminal portion of the common duct, hoping thereby to reestablish the normal flow of bile into the duodenum ultimately, when the obstructing inflammatory reaction subsides. In some of these cases external common duct drainage gives excellent results, although in others permanent biliary fistula develop. Anastomosis of the common bile duct to the duodenum at the primary operation has given gratifying results in the hands of experienced surgeons.

The operative mortality of biliary-intestinal tract anastomosis should be considered in the selection of the operation for a given case of obstructive icterus. In a group of cases collected from several sources, Eliason and Johnson (9) have reported some very illuminating statistics regarding the operative mortality that attends these procedures:

Number of cases	Operation	Deaths	Mortality rate (percent)
58	Choledochoduodenostomy	5	8.6
13	Cholecystogastrostomy	3	23.0
44	Cholecystoduodenostomy	14	31.8
13	Hepaticoduodenostomy	5	38.4

The low operative mortality of choledochoduodenostomy is impressive in consideration of the prominent place that gallbladder anastomosis held in present day surgical literature.

The operation of choledochoduodenostomy is most commonly performed as a lateral anastomosis (1) (3), although an end-to-end technic has been described. (3) (10). The lateral anastomosis may be performed by a simple suture technic or over a straight catheter-like tube (3) (11) (12) or a T-rubber tube for support, (3) (13) (14). Where the patent portion of the common duct is small size, anastomosis becomes difficult or virtually impossible. Depending on the merits of each case, special procedures may be employed including the use of autogenous tissue grafts, direct implantation or indirect implantation of the duct (3) (15).

Regardless of the type of reconstruction decided upon for the relief of obstructive jaundice, appropriate preoperative management will result in a lowering of the operative mortality and the postoperative

morbidity. Among the important preoperative measures are included a high carbohydrate diet with adequate protein content, administration of vitamin K and bile salts, and the intravenous use of dextrose solutions and blood transfusions when needed, (16) (17).

The following case reports are published with a view of inviting attention to the advantages that choledochoduodenostomy possesses over cholecystenterostomy.

CHOLECYSTOGASTROSTOMY

CASE 1.

F. S. S., Major General, U. S. Army, retired, white, married, age 75, was admitted to the hospital on December 17, 1931.

Chief complaints.—Pain in epigastrium, nausea, jaundice, chills and fever.

Family history.—Irrelevant.

Past history.—History of an attack of anemia and jaundice in 1926 which improved with medical therapy and blood transfusions. Type and cause of anemia was not determined. Since that time has taken iron and liver extract from time to time.

History of chief complaint.—On October 1, 1931, he developed abdominal pain localized in the epigastrium and associated with nausea and vomiting. He gradually became jaundiced and suffered variable fever and chilling.

In 1929 and 1930 he suffered similar attacks of upper abdominal pain, fever and chills, but was not jaundiced. He recovered from those attacks without any special treatment. For several years has had some flatulence and has been unable to eat certain coarse vegetables and fatty foods for several months.

Physical examination.—He appeared somewhat icteric and emaciated. Examination of the head, neck, heart and lungs revealed no significant abnormality. The abdomen was flat and free from masses, rigidity and local tenderness. A low grade intermittent fever was present.

Laboratory examinations.—The Kahn precipitin test for syphilis was negative. A routine chemical and microscopical urinalysis was normal. A complete blood count revealed a secondary anemia of moderate severity. Icterus index was moderately increased and the van den Bergh reaction was immediate and direct. A flat x-ray plate of the abdomen was negative for opaque gallstones. Barium meal revealed no apparent gastro-intestinal pathology.

Working diagnosis.—Cholecystitis, chronic with obstructive jaundice, probably a calculus in the common duct; secondary anemia.

Treatment.—With bed rest, low fat and high vitamin diet, and intravenous calcium therapy patient gained in weight and the jaundice partially cleared. Operation was decided upon and was preceded by intravenous infusions of dextrose solution.

Operation.—On January 4, 1932, under 150 mg. novocain crystal spinal anesthesia supplemented by nitrous oxide-oxygen inhalations, laparotomy was performed. The gallbladder was found to be thickened and contracted. It contained 50 to 60 stones. Peritoneal adhesions between duodenum and gallbladder were present. The head of the pancreas was very hard and apparently produced compression of the common bile duct. Cholecystolithotomy, cholecystogastrostomy, and transfusion of 500 cc. whole blood performed.

Progress.—The immediate postoperative course was uneventful, the jaundice gradually clearing and general strength improving. Before leaving the hospital on March 2, 1932, he had gained 13½ pounds.

Follow-up.—On December 29, 1934, he was readmitted to the hospital because of nausea and vomiting. Since his discharge from the hospital he had been well except for occasional gastro-intestinal upsets and weakness. Because of a tendency to anemia he has been taking liver extract and iron regularly. Physical examination revealed a lemon tinted skin, systolic murmur at aortic area with slight cardiac hypertrophy. Blood pressure 140/65. Abdomen soft with a well healed upper right rectus operative scar. Red blood cells 3,830,000. Hemoglobin 80 percent. Icterus index 8. Electrocardiography reveals left axis deviation. Gastro-intestinal series negative except for a small amount of barium retained in gallbladder area at 6 hours. With symptomatic treatment he improved and was discharged to his home on January 11, 1935.

On the following day he returned to the hospital because of a recurrence of nausea and vomiting associated with abdominal pain and temperature of 100° F. Physical findings otherwise unchanged. Due to recent nature of symptoms, exploratory laparotomy was decided upon and was done on February 18, 1935. Under nitrous oxide-oxygen-éther inhalant anesthesia the abdomen was opened. The findings were noted: "Cholecystogastrostomy functioning well. Advanced sclerosis of liver. Pancreas nodular and very hard. Common and hepatic ducts clear."

Following this operation he was very weak and vomited frequently despite usual postoperative therapy. He gradually became more weak and at times irrational. Died on March 9, 1935. Unfortunately autopsy was not permitted.

Final clinical diagnosis.—Pancreatitis, chronic, cirrhosis, liver.

SUCCESSFUL CHOLEDOCHODUODENOSTOMY FOLLOWING TWO UNSUCCESSFUL CHOLECYSTOGASTROSTOMIES

CASE 2

C. A. H., chief machinist's mate, United States Fleet Reserve, white, married, age 49, was admitted to the hospital on September 16, 1937.

Chief complaints.—Pain in right upper abdomen, nausea, jaundice, and weakness.

Family history.—Irrelevant.

Past history: Mumps, whooping cough, and rheumatism in childhood. Tonsillectomy and a submucous resection were performed in 1925. Gonococcus infection, urethra, in 1910, 1919, and 1925.

History of chief complaint.—In 1931 he developed upper abdominal pains, and vomited a large amount of blood on one occasion. He was hospitalized in Panama where a diagnosis of duodenal ulcer was made, and he improved rapidly under medical treatment. Two years later there was a recurrence of peptic ulcer symptoms, and he was again treated medically with considerable benefit.

On October 22, 1934, he reported to the hospital with a history of having vomited blood, and having passed blood in his stool. A gastro-intestinal series revealed evidence of a chronic duodenal ulcer with partial obstruction. On November 22, 1934, a duodenal ulcer, which was adherent to the pancreas, was excised and a pyloroplasty performed. Histopathological examination of the excised tissue revealed no evidence of malignancy. A post-operative gastro-intestinal series revealed relief from the previously reported gastric retention. On February 15, 1935, he left the hospital free from symptoms.

On April 3, 1935, he was readmitted to the hospital complaining of bloody vomitus, tarry stools, and jaundice of 10 days' duration. Clinical and laboratory study revealed evidence of a moderately severe secondary anemia and

jaundice of an obstructive type. On May 29, 1935, his abdomen was reopened, and the gallbladder was found to be greatly distended, the tissue about the common duct was markedly indurated, and the head of the pancreas was indurated, giving the impression of malignancy. A cholecystogastrostomy was performed. He left the hospital, free from symptoms, on June 24, 1935.

Because of recurrence of pain in the right upper quadrant, vomiting, and constipation, he returned to the hospital on February 1, 1936. A barium meal showed evidence of a duodenal ulcer with obstruction. He improved with dietetic treatment to such an extent that he was able to leave the hospital 24 days later.

In April 1936 he developed intermittent jaundice, with fever, vomiting, pain in the upper right abdomen, and tarry stools. He returned to the hospital on May 14, 1936, at which time physical examination and laboratory study revealed an obstructive type of jaundice apparently due to an ascending suppurative cholangitis, and an associated severe secondary anemia. He improved somewhat with liver therapy and other supportive measures, leaving the hospital on June 30, 1936.

His condition failed to improve at home, and he again returned to the hospital on August 28, 1936. On October 8, 1936, the abdomen was opened surgically for the third time. The pancreas then appeared normal, but the stoma between the stomach and the gallbladder was not functioning, and the gallbladder and the common bile duct were greatly dilated. The anastomosis between the gallbladder and the stomach was reconstructed, and after an uneventful convalescence, he left the hospital on November 6, 1936, free from symptoms.

Early in 1937 the jaundice and vomiting recurred with an intermittent fever, and he returned to the hospital on March 16, 1937. With supportive treatment he improved gradually, and left the hospital on April 15, 1937, much improved. He was again hospitalized from June 21, 1937 to July 9, 1937, due to recurrence of symptoms.

During the past 2 months he had been growing more weak, and had been nauseated continuously. There had been a recurrence of the pain in the right upper abdomen, and jaundice had been marked. He was very depressed mentally, and returned to the hospital again for treatment of his complaints.

Physical examination.—He appeared emaciated, and was moderately jaundiced. The tonsils were surgically absent and the gums were edentulous. The systolic blood pressure was 118 millimeters mercury, and the diastolic blood pressure was 66 millimeters mercury. There were right upper abdominal scars from previous surgery, with some tenderness in the right hypochondrium. No other physical findings of significance were noted, except a low grade intermittent fever.

Laboratory examinations.—The Kahn precipitation test for syphilis was negative. Routine chemical and microscopic study of the urine revealed no abnormality. The red blood cells numbered 4,100,000 per cubic millimeter, with hemoglobin 80 percent. There were 11,600 leukocytes per cubic millimeter of blood, with band forms 10 percent, segmented 63 percent, lymphocytes 21 percent, eosinophiles 2 percent, and monocytes 4 percent.

Working diagnosis.—Obstruction of common bile duct due to scar tissue from previous injury.

Operation.—On September 20, 1937, the abdomen was reopened under spinal anesthesia, supplemented by nitrous oxide-oxygen-ether inhalations. The gallbladder was thickened, and the anastomosis between it and the stomach was practically closed. The common duct was dilated, and the head of

pancreas was stony hard. Cholecystectomy and later choledochoduodenostomy were performed.

Histopathological examination.—Specimen consists of a gallbladder measuring approximately 9 centimeters in length. The wall is thickened and fibrous. The mucosa is smooth. An opening has been made in the lumen and the contents have drained. There is a small lymph node adherent to the gallbladder near the cystic duct. This node measures 1 centimeter in diameter.

Microscopic: The gallbladder is greatly thickened by dense fibrosis that gives evidence of having been formed over a long period. Engrafted upon this chronic fibrosis is a more recent inflammatory process of subacute intensity. This lymph node also shows an acute inflammatory reaction in tissue that is fibrotic and scarred from old infection. There is no evidence of malignancy.

Diagnosis.—Cholecystitis, chronic.

Progress.—Postoperatively there was some pulmonary atelectasis, and for the first 10 days the temperature was intermittently as high as 100° F. His subsequent convalescence was uneventful and he left the hospital without complaints or clinical jaundice on October 29, 1937.

Because of recurring symptoms of duodenal ulcer with gastric retention, he returned to the hospital on November 1, 1937. A posterior gastro-enterostomy was performed 9 days after admission, and he left the hospital free from symptoms, after a quiet convalescent period, on December 3, 1937.

He was interviewed on April 12, 1938, at which time he had no complaints and appeared to be in excellent health.

SUMMARY

1. Choledochoduodenostomy appears to be the operation of choice in cases of chronic biliary stasis due to removable lesions involving the terminal portion of the common duct.

2. The principal objections to cholecystenterostomy are:

a. The tendency to closure of the stoma due to progressive chronic inflammatory changes in the gallbladder wall which may act as a focus of infection.

b. The marked frequency of ascending infection of the bile ducts with subsequent hepatitis and cirrhosis.

c. Formation of calculi in the retained gallbladder with a recurrence of obstruction as a result thereof.

d. High operative mortality.

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PRIMARY CARCINOMA OF THE STOMACH WITH METASTASES TO SKIN AND SUBCUTANEOUS TISSUE

A CASE REPORT[1]

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It is unusual and noteworthy that the skin, which is the largest organ in the body, is seldom the site of metastatic lesions, especially in cases where widespread involvement is present.

From January 1, 1931, to January 1, 1939, there were 332 patients with primary carcinoma of the stomach admitted to Hines Hospital. In only 1 case, or 0.03 percent, metastases to skin was present.

Criep and Miebr (1) found only 137 cases of carcinoma of the stomach with skin metastases up to 1933 in both the foreign and domestic literature. Lubarsch, quoted by Guilbert (2) found only 0.04 percent metastasizing to skin in a series of 2,738 cases of gastric carcinoma. Suguki (3) reviewed 110 cases from the literature in which skin metastasis from cancer of internal organs was pres-

FIGURE 1.—METASTATIC NODULES IN SKIN AND SUBCUTANEOUS TISSUE FROM
PRIMARY CARCINOMA OF STOMACH.

ent and he noted that in most of the cases primary carcinoma of the stomach was the etiological factor. A similar conclusion has been reached by others studying the incidence of metastatic lesions to skin. Gates (4) reviewing cases of cutaneous metastases of malignant disease from the literature found that carcinoma of the stomach produced the majority of secondary skin lesions. Edel (5) collected 75 cases from the literature in which cutaneous metastases occurred in an attempt to compare the frequency of secondary skin tumors from carcinoma of the stomach with carcinoma of the other organs. He found that carcinoma of the stomach accounted for most cases.

Metastatic lesions to skin from carcinoma of the stomach are most commonly located in the skin of the abdomen and thorax, and, especially, about the umbilicus. (See figure 1.) The metastatic cells probably reach this region via the lymphatics of the ligamentum teres when metastatic nodules are present in the liver. The metastatic nodules are usually firm, round, or ovoid, and discrete, freely movable, and not painful. Pigmentation is generally not seen. Practically no symptoms are produced by the nodules unless secondary infection or pressure necrosis is present. The nodules are usually discovered by accident by the patient. They may occur relatively early or late in the disease. The time of their appearance, in other words, has no relation to the extent of the primary lesion.

CASE REPORT

A white male, aged 43, farmer, entered the hospital April 21, 1938, with the chief complaints of epigastric distress and loss of weight.

Family history.—Father living and well. Mother dead, the result of an accident. Two brothers deceased. Two sisters and five brothers living and well. Married, and wife and four children living and well. No history of cancer, diabetes mellitus, insanity, or heart disease in family.

Past history.—Had typhoid fever at the age of 18. Measles, mumps, whooping cough, and pneumonia as a child. Two ribs fractured in an accident. Does not drink or use drugs. Denies venereal disease. Occupation has always been farming.

Present illness.—Has had a history of epigastric distress since 1920 with a very gradual loss of weight. The epigastric pain usually followed meals and was relieved by food and alkalies since 1920. At irregular intervals, he has had tarry stools. In 1930 he had a severe attack of epigastric pain, nausea and vomiting. He was told by a physician at that time that he had a peptic ulcer. His symptoms were relieved by dietary management and he remained in good health relatively free of symptoms until about April 1937 when he had another attack of epigastric distress, nausea, and vomiting. He lost about 12 pounds in weight in a short period of time. He entered a tubercular sanatorium and while there he improved sufficiently to return to his farm work. In December 1937 he again became very ill with epigastric distress, loss of weight and weakness. He returned to the tubercular sanatorium. Roentgenographic studies revealed a carcinoma of the stomach. A small nodule located in the skin above the umbilicus

was removed, and the histological examination revealed it to be a metastatic carcinoma. He was referred to another hospital for treatment.

Physical examination.—Examination revealed a white male, aged 43, appearing critically ill, poorly nourished and with numerous nodules in the skin of the thighs, groin, abdomen, anterior, and posterior parts of the back and chest. Head and neck negative. Heart and lungs negative. A well-healed scar was noted midway between the xiphoid process and the umbilicus. A firm, fixed mass was palpable in the epigastric region. Liver, spleen, and kidneys not enlarged. Rectal examination negative. The skin was dry and parchmentlike, and contained scattered firm, freely movable nodules of varying sizes. No palpable nodes in the cervical, epitrochlear, axillary, or inguinal regions.

Laboratory data.—Urinalysis: albumin, three plus; white blood cells moderate; red blood cells few and epithelial cells few. Wassermann and Kahn negative. Blood count: red blood cells, 4,230,000; white blood cells, 9,300; hemoglobin, 80 percent; nonprotein nitrogen, 31.4. Gastric analysis was not done.

Roentgenological study.—Gastro-intestinal examination revealed an extensive carcinoma involving more than three-fourths of the stomach. No obstruction was noted. The chest was normal.

Histological study.—The biopsy taken from the anterior abdominal wall at the tubercular sanatorium was reviewed and reported as metastatic adenocarcinoma from the stomach. A biopsy from the anterior abdominal wall at the hospital revealed a similar histological diagnosis.

Progress while in hospital.—Because of the extent of the lesion, the presence of numerous metastatic nodules in the skin and subcutaneous tissue, and the patient's poor general condition, palliative symptomatic treatment only was advised. He gradually became worse and expired June 28, 1938.

CONCLUSIONS

Although cutaneous metastases may result from malignant lesions of various organs, the majority originate from primary carcinoma of the stomach. The metastatic lesions are usually painless, firm, discrete, and freely movable. The time of their appearance has no relation to the size of the primary lesion. Cutaneous nodules should always be biopsied where any doubt exists as to their true nature.

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A DIETARY TREATMENT FOR ASTHMA AND HAY FEVER [1]

By Lieutenant Commander Emanuel M. Abrahamson, Medical Corps, United States Naval Reserve

In a recent communication (1), the theory was advanced that hyperinsulinism is a necessary factor for the production of attacks of bronchial asthma in sensitive individuals. This theory was suggested by a comparison between asthmatics and diabetics who are diametrically opposed in the following characteristics:

ASTHMATICS	DIABETICS
1. Tendency to low fasting blood glucose.	1. High fasting blood glucose.
2. Frequently associated with hypothyroidism and improved with hyperthyroidism.	2. Made worse by engrafting of hyperthyroidism.
3. Aggravated by administering NaCl.	3. Improved by administering NaCl.
4. High serum potassium.	4. Low serum potassium.

In addition it has been amply demonstrated that while the two diseases are very frequently found in members of the same family, their concomitant occurrence in the same individual is of extreme rarity.

It was therefore assumed that asthma had some relation to hyperinsulinism, the endocrinological opposite of diabetes, or hypoinsulinism. This hypothesis was tested in a number of patients all of whom had had asthmatic attacks on an allergic basis. These expectations were completely realized. Each patient responded to a 6-hour glucose tolerance test with a drop in blood sugar well into the hypoglycemic range.

As a therapeutic test, these same patients were placed on the Harris diet (2), which has been shown to be efficacious in correcting the metabolic error. The response was most gratifying. The patients were enabled to go through their asthma seasons without recourse to desensitizing injections, or to the administration of adrenalin, and they remained reasonably comfortable. Their glucose tolerance curves were then normal.

Thus it was shown that hyperinsulinism is a constant finding in asthmatics and that correction of the metabolic defect simultaneously relieves the patients of attacks. This affords an explanation of the well known fact that asthmatics are especially prone to nocturnal attacks. The blood sugar in persons with hyperinsulinism is most apt to be low in the early hours of the morning.

Now, if this theory is true, there should be no cases of asthma in

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[1] Received for publication November 14, 1941.

diabetics. Such combined cases, however, do occur, although rarely. This difficulty is removed if a mechanism can be found which permits the development of spontaneous hypoglycemia in diabetics. Harris (3) has described this very condition which he calls dysinsulinism. He postulates a time lag in the elaboration of endogenous insulin in response to a metabolic demand with a subsequent overproduction of the hormone. While this concept is still somewhat controversial, Harris has published curves which show typical diabetic responses during the first 2 or 3 hours after the ingestion of glucose with a marked hypoglycemia on prolonging the test to 6 hours. No matter what is the exact mechanism that brings this phenomenon about, there are some diabetics who can develop spontaneous hypoglycemia without the administration of any exogenous insulin.

Five cases of asthma in diabetics were studied. The findings of two of them are of sufficient interest to warrant reporting in detail.

CASE 1

B. A., housewife, age 53, was first seen in private practice in February 1935. She had been diabetic for about 5 years. Her blood sugar was 181 mg. per 100 cc. Her urine became sugar-free on a diet of C-150, P-60, F-50, without insulin.

Shortly thereafter, she complained of pruritus vulvae and was told to take 10 units of regular insulin twice a day in connection with the same diet. Her blood sugar was 284 mg. per 100 cc. In a few weeks, it dropped to 160 and the pruritus disappeared.

She moved away and was not seen for some time thereafter. In May 1937 she "caught cold" and had a very persistent cough with a slight febrile reaction. After a month with no relief, she entered the hospital. The wheezing and breathlessness had become intolerable.

During her stay in the hospital, she had severe nocturnal asthmatic attacks. Soon after falling asleep, she was awakened by a sense of suffocation and she had to sit up in bed for the greater part of the night. Complete physical and laboratory investigation failed to reveal any organic basis for her symptoms. She finally secured some relief by a "shot gun" mixture of ephedrine, amytal, and codeine.

She left the hospital somewhat improved. However, she continued to suffer from asthmatic attacks which gradually became worse and she soon found it necessary to carry a syringe and adrenalin with her at all times. She required 0.5 cc. of the 1:1000 solution about once every 3 hours. She was especially prone to these attacks at night and she invariably took an injection before attempting to sleep and she kept a loaded syringe near her bed. She had to use the drug at least once each night, most frequently twice.

About 6 months after her discharge from the hospital, her physician prescribed 25 units of protamine zinc insulin per day. With this, she was under satisfactory diabetic control.

In November 1939, her physician referred her to the allergy clinic. She was tested and found to be slightly sensitive to dust, feathers, wheat, milk, rye, and buckwheat. A nasal smear contained 9 percent eosinophiles.

She was referred to the diabetic clinic for control of her metabolic condition. A 6-hour glucose tolerance test was performed:

Fasting	Hours after ingesting 100 grams of glucose					
	1	2	3	4	5	6
[1] 200 [2] 0.2%	[1] 288 [2] 1.2	[1] 333 [2] 3.6	[1] 326 [2] 2.8	[1] 214 [2] 2.4	[1] 115 [2] 0.6	[1] 67 [2] 0

[1] Mg. glucose per 100 cc. of blood.
[2] Grams of glucose excreted.

She had promised to try not to take any adrenalin during the night preceding the test. However, she found it urgently necessary to take an injection at about 3 a. m. The test was started at 8:30 a. m. She was wheezing very slightly at the beginning. After taking the glucose, she was more comfortable and her breathing became quiet. At the fourth hour, she began to have some slight respiratory embarrassment. This was worse at the end of the fifth hour and intolerable at the sixth. She was given a glass of milk and soon became fairly comfortable. Half an hour later, her blood sugar was 130 mg. per 100 cc.

She was prescribed the Harris diet and told to discontinue insulin.

By the middle of January 1940 she noticed a decided subjective improvement. She found that her asthmatic attacks could be controlled by but 0.25 cc. of the adrenalin solution and that she could go for 5 to 6 hours between doses. Her glycosuria remained trivial.

After 3 months, she reported that she required only one or two injections of adrenalin per day. Her diabetes was under even better control than it had been with insulin.

This improvement continued until August 1940. Then she began to drink black coffee. She soon noticed a return of the asthmatic symptoms. Being intelligent enough to help herself, she stopped taking the beverage without instruction and she soon became almost entirely free from asthmatic attacks.

By January 1941 she found that she could go for weeks without taking any adrenalin. Only during very stormy weather did she find it necessary to take a tiny dose. A nasal smear taken at this time was free from eosinophiles. A glucose tolerance test was made in February:

Fasting	Hours after ingesting 100 grams of glucose					
	1	2	3	4	5	6
[1] 179 [2] 0	[1] 326 [2] 1.9	[1] 300 [2] 3.5	[1] 300 [2] 1.9	[1] 214 [2] 1.8	[1] 179 [2] 0.5	[1] 166 [2] 0.2

[1] Mgs. glucose per 100 cc. of blood.
[2] Grams of glucose excreted.

Thus her glucose tolerance test became typically diabetic.

This improvement has continued and at present (November 1941) she has not taken any adrenalin at all for more than 6 months.

CASE 2

J. B., housewife, age 43, was first admitted to the hospital in March 1935 for parturition. No glycosuria was discovered during her pregnancy or labor.

Five months after the birth of her baby, she came to the medical clinic complaining of a loss of 4 pounds in 2 weeks, weakness, and severe pruritus vulvae. A casual specimen of urine contained 1.8 percent sugar. She was referred to the diabetic clinic.

Her diabetes was deemed mild enough for control without insulin and she was prescribed a diet of C–150, P–60, F–50. Her initial weight was 115 pounds.

She continued this diet until April 1936. Her pruritus had cleared up promptly but her weight dropped to 110 pounds. She was therefore advised to take 10 units of regular insulin before breakfast.

On her next visit, she complained of large wheals which came up at the sites of the insulin injections. She was referred to the allergy clinic where she was tested with all available brands of insulin and found to be sensitive to the hormone itself. She was desensitized with progressively larger doses.

In August 1936 her fasting blood sugar was 244 mg. per 100 cc. The insulin dosage was increased to 10 units twice a day and later changed to 15 units of protamine zinc insulin per day.

She had her first asthmatic attacks in November 1937. Her fasting blood sugar at that time was 207 mg. per 100 cc. She was tested in the allergy clinic and found to be sensitive to many foods, pollens, animal dandruffs and feathers. Desensitization was instituted, but without any relief.

She continued to suffer attacks of varying severity until August 1939. A glucose tolerance test was performed:

Fasting	Hours after ingesting 100 grams of glucose					
	1	2	3	4	5	6
[1] 140 [2] 0	[1] 272 [2] 2.0	[1] 300 [2] 6.0	[1] 268 [2] 3.9	[1] 172 [2] 1.5	[1] 84 [2] 0	[1] 54 [2] 0

[1] Mgs. glucose per 100 cc. of blood.
[2] Grams of glucose excreted.

At the fifth hour, her breathing became audible and she felt it "a bit heavy." At the sixth hour, she had a severe asthmatic attack. Her breathing was loud enough to be heard across the room, and auscultation of her chest revealed many expiratory squeaks. She was given a glass of milk and she began to feel better in a few minutes. In 15 minutes, the rales had disappeared. In another 15 minutes, her blood sugar was 79 mg. per 100 cc.

She was then placed on the Harris diet with 20 units of protamine zinc insulin per day. When told about avoiding coffee, she admitted a consumption of 12 cups a day.

On her next visit 2 weeks later she reported that she was very much more comfortable except for a daily attack of wheezing when she awoke. This disappeared promptly after breakfast. It was considered to be the effect of the protamine zinc insulin, which frequently produces low morning blood sugar levels. She was told to take 10 units of regular insulin before breakfast and before dinner.

She then noticed that she had two wheezing episodes daily—just before lunch and late in the evening. These times correspond to those of lowest blood sugar after insulin. She was accordingly advised to omit insulin altogether. It was expected that the attacks would disappear entirely.

This hope was not realized for she began to have attacks at irregular intervals. On questioning, she admitted that she had discontinued the Harris diet because she feared that her diabetes would become worse. After reassurance, she followed the diet more closely and, after a week, had no major attacks. She still had a slight "heaviness" in her chest at times. She found that if she took a little food she obtained prompt relief. After another lunch even these slight attacks disappeared completely.

For several months, she never passed more than 6 grams of glucose a day. In February 1940 it was noticed that her glycosuria began to increase. She also had a slight wheeze, more pronounced in the morning. Questioning revealed that she began to cheat as regards coffee. After a reprimand, she promised better cooperation. Her wheeze soon disappeared and her glycosuria dropped to insignificant values.

She was entirely comfortable as regards any asthmatic symptoms. However, her diabetes gradually became worse. A fasting blood sugar, determined in August, was 238 mg. per 100 cc. She was prescribed 10 units of protamine zinc insulin per day. She continued to be comfortable but the glycosuria persisted. The insulin dosage was gradually increased until she reached 40 units in October 1940.

In January 1941, in response to repeated letters from the allergy clinic which she had not attended for over a year, she returned to that department. She was tested and found to be sensitive to feathers. Her other sensitiveness gave negative skin tests. A nasal smear showed but 1 percent eosinophiles.

Fasting	Hours after ingesting 100 grams of glucose					
	1	2	3	4	5	6
[1] 140 [2] 0	[1] 246 [2] 0.3	[1] 333 [2] 2.0	[1] 312 [2] 2.4	[1] 319 [2] 1.6	[1] 217 [2] 0.8	[1] 143 [2] 0.1

[1] Mg. glucose per 100 cc. of blood.
[2] Grams of glucose excreted.

This is a purely diabetic curve.

She continued in this status up to the present (November 1941). She still takes 40 units of protamine zinc insulin per day. She is no longer on the Harris diet.

Three other diabetic-asthmatics were tested and they gave entirely similar curves:

Case	Fasting	Hours after ingesting 100 grams of glucose					
		1	2	3	4	5	6
3	141	278	265	214	149	125	64
4	107	203	208	151	122	65	64
5	125	214	179	109	75	56	42
5 [1]	[2] 136	[2] 240	[2] 245	[2] 220	[2] 186	[2] 164	[2] 128

[1] After dietary treatment.
[2] Mg. glucose per 100 cc. of blood.

The foregoing experiments logically lead to the assumption that ordinary hay fever might also yield to the same treatment as has proven so efficacious against asthma. Accordingly, six cases of seasonal allergy with symptoms of hay fever, but without any asthma, were investigated in the same manner.

Glucose tolerance tests, performed during the Summer of 1941, were as follows:

Case	Fasting	Hours after ingesting 100 grams of glucose					
		1	2	3	4	5	6
1	112	134	116	84	72	[1] 56	
2	89	140	96	84	68	62	[1] 56
3	108	133	100	90	76	70	[1] 58
4	100	148	98	96	96	82	[1] 66
5	96	128	94	82	84	[1] 62	
6	88	134	92	80	68	64	[1] 61

[1] The test was continued until the patient complained of sneezing or other symptom of hay fever. The test was terminated by giving him a glass of milk and recovery was prompt in each case. All of these curves are typical for hyperinsulinism.

The patients were placed on the Harris diet. In a few days, each declared that the symptoms were negligible. No other treatment was given although each patient had been given coseasonal treatment with pollen extracts during the previous 1 or more years. They remained on the diet throughout their hay fever seasons and then reverted to their usual fare but avoided coffee and sweets.

The first case was of a boy of 11 who had had severe hay fever for 3 years. He went to a camp in a locality with much rag weed and remained comfortable. On his return home in the fall he began to go off his diet. He drank three bottles of a popular caffeine beverage. That night, he was awakened by a severe fit of sneezing which persisted for almost an hour. He was uncomfortable for a few days afterward. Then the symptoms cleared up. He was not entirely convinced about the causative relation between the beverage and the attack and he repeated the experiment a week later. The result was exactly the same.

DISCUSSION

In a previous paper, a summary of which was given at the beginning of this article (1), it was shown that asthma and diabetes have a reciprocal relation and that, in a sense, each exerts a protective influence against the other. It was further shown that hyperinsulinism, the endocrinological opposite of diabetes, is a constant accompaniment of asthma. It was therefore assumed that hyperinsulinism is a characteristic of asthmatics, who have their attacks when the blood glucose drops below the normal range.

That being the case, asthma and diabetes should not only be rarely associated, they should indeed be entirely exclusive unless a mechanism could be found that permits the occurrence of spontaneous hypoglycemia in diabetics. In the cases of diabetic asthmatics investigated, each patient gave a glucose tolerance test that meets all the criteria for dysinsulinism—for the first few hours they had diabetic curves and this was followed by a drop in blood glucose into the hypoglycemic range as the test was prolonged. When these patients were treated by the Harris diet, which corrects hyperinsulinism, the attacks of asthma disappeared and the glucose tolerance curves then became purely diabetic in form.

Some of the asthmatic-diabetics can be treated purely by the Harris diet. In some cases the adjustment is so good that the two conditions tend to eliminate each other and the diabetic can maintain good comfort and metabolic control without taking any insulin.

Diabetic diets permit the drinking of large amounts of coffee. In fact, patients are often encouraged to drink black coffee in order to help them in sticking to their diets. This is seen to be dangerous, for persons who already have an impairment of their insulin apparatus had better avoid caffeine which Harris has shown to be capable of playing havoc with that function. This will be explained presently.

The next logical step is to assume that hay fever would behave in the same manner as asthma, both being allergic manifestations. Experiments were made to test this hypothesis with gratifying results, both diagnostically and therapeutically.

The Harris diet consists, in essence, of a high fat, low carbohydrate diet with the food divided into frequent small meals. The high fat has a depressing effect on the oversensitive insulin apparatus. Quickly absorbable carbohydrates, such as candy, sugar, cake, and the richer fruits and vegetables, are avoided. This is done to avoid any stimulus to the already too sensitive islet cells which respond to any elevation in blood glucose by pouring their secretion into the circulation. The food is taken in small quantities to enable the body to absorb nourishment and still keep the rate of glucose absorption down so as to avoid any stimulus to the insulin apparatus. The frequency of feeding prevents any post prandial drop in blood glucose that would give rise to symptoms. Caffeine is avoided absolutely. The effect of caffeine is very much the same, as far as the blood is concerned, as that of carbohydrate ingestion. It induces a rapid glycogenolysis and the sudden increase in blood sugar stimulates the pancreas to produce insulin. Indeed, Harris has found that overindulgence in caffeine beverages is a common cause for hyperinsulinism.

The Harris diet is as follows:

On arising.—Four ounces of orange juice.

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Breakfast.—One fruit with or without cream—no sugar; 1 serving of cereal with cream—no sugar; 1 egg; 2 or 3 slices of bacon, if desired; 1 slice of bread or toast with butter (liberally) ; Postum, caffeine-free coffee, or very weak tea— no sugar.

Two hours after breakfast : 3 ounces of orange juice or 4 ounces of tomato juice.

Three hours after breakfast : 1 glass of milk.

Dinner.—Soup—cold or jellied chicken or beef consommé, or tomato juice; 1 portion (100 grams) of 5 percent vegetables; 1 portion (100 grams) of 10 percent vegetables; 1 large portion of meat, poultry, or fish; 1 slice of bread or toast; fruit with cream.

Three hours after dinner : 1 glass of milk.

One hour before supper : 3 ounces of orange juice or 4 ounces of tomato juice.

Lunch or supper.—One meat substitute—egg, fish, or cheese; 1 salad—large serving of lettuce, cole slaw, tomato or Waldorf salad with mayonnaise or French dressing; 1 portion of 5 percent vegetables; 1 slice of bread with plenty of butter; fruit.

Two or three hours after supper : 1 glass of milk.

Every two hours until bed time : 4 ounces of orange or tomato juice.

This diet is best followed precisely for at least 3 weeks. Then, the extra feedings can be dropped cautiously and gradually. After about 2 months, the patient can revert to a normal threemeal diet. However, sweets had best be kept to a minimum and caffeine should be permanently interdicted.

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PLATE 8
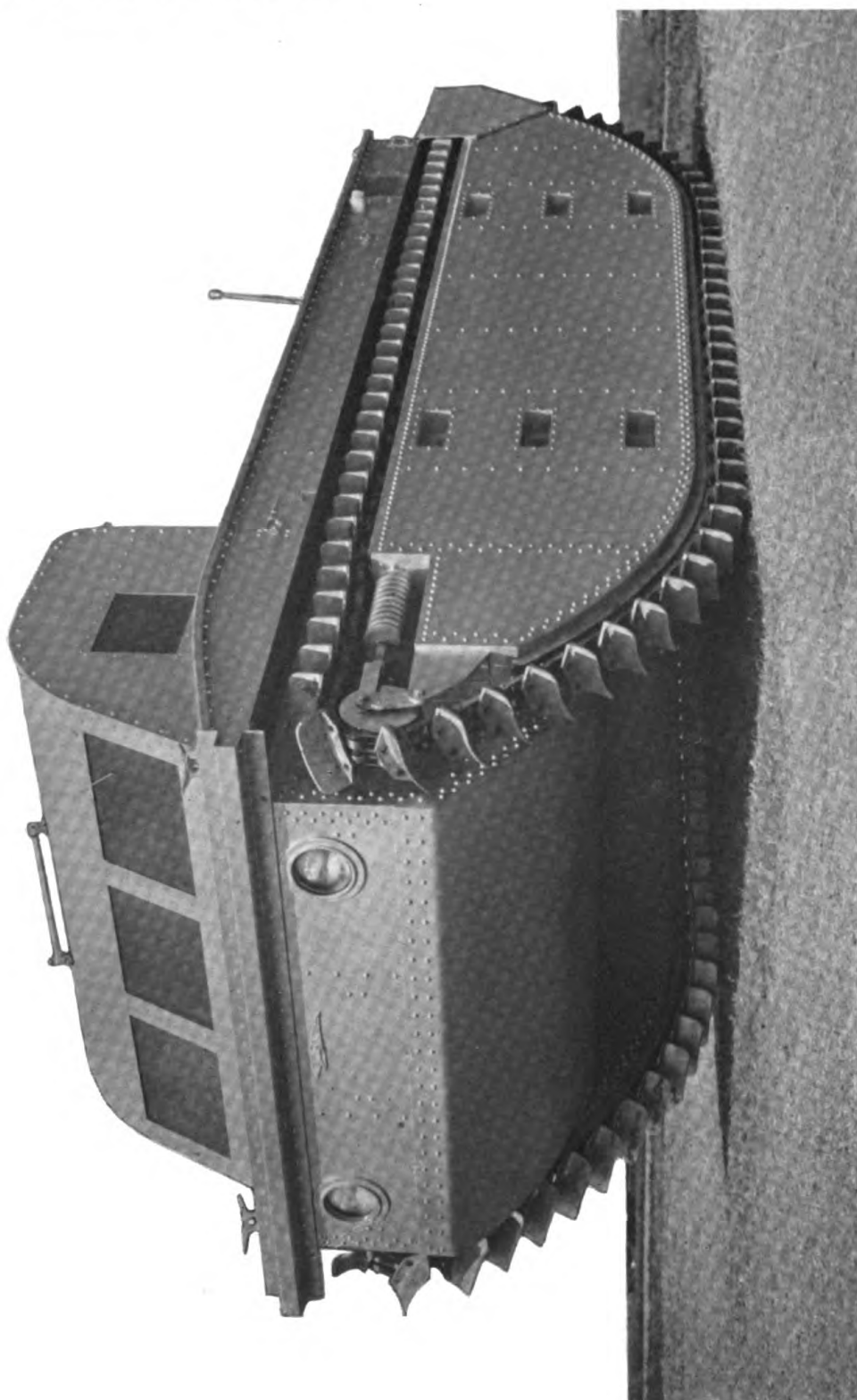
FIGURE 1.—SHOWING AMPHIBIAN TRACTOR.
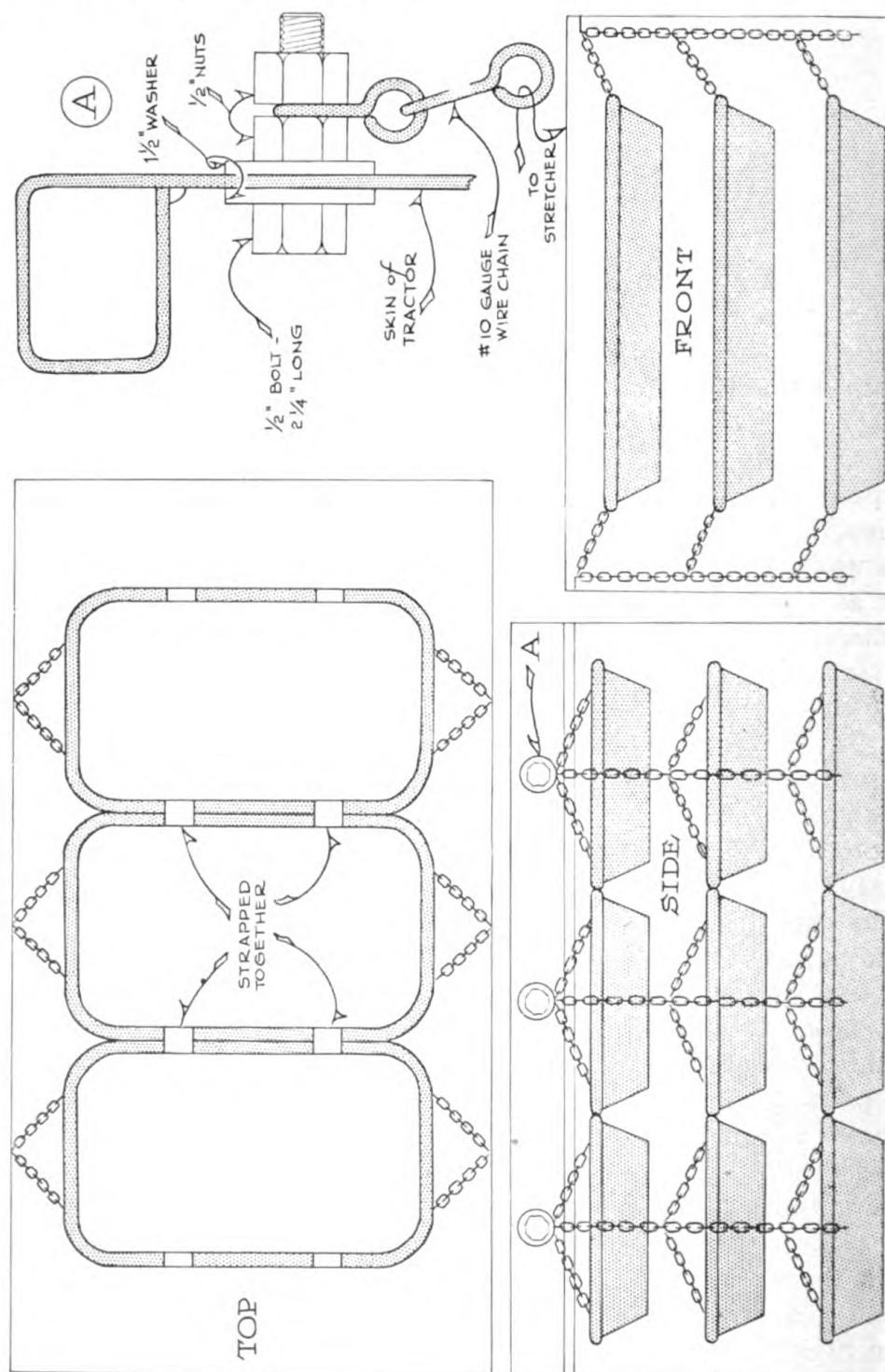
FIGURE 2.—ARRANGEMENT OF LITTERS IN AMPHIBIAN TRACTOR SHOWING METHOD OF ATTACHMENT.

MEDICAL AND SURGICAL DEVICES

"ALLIGATOR" AMBULANCE

By Lieutenant, junior grade, Newman H. Newhouse, Medical Corps, United States Naval
Reserve

The amphibian tractor, originally named a "mercy tank" or "swamp buggy," and now generally known as the "alligator," is a gasoline-driven, track-pulling amphibious vehicle. It was designed by Mr. Donald Roebling, of Clearwater, Fla., for rescue and relief work in the storm-stricken areas of Florida. The "alligator" has been through 5 years of comprehensive testing and improvement, and in spite of some mechanical difficulties at the present time, its fundamental purpose remains unchanged.

It was not intended to be used as a combat vehicle but more properly as a means of transporting supplies and matériel from ships to shore in one continuous trip, particularly where the shore line and inland terrain is of a swampy nature and the net is such that it precludes the use of motor transports in supplying advance units.

Using this method the time element between actual injury and adequate treatment is reduced to a minimum; the ride is more comfortable than in an ambulance over rough terrain and it is much smoother than in a boat on a rough sea. Additional shock is lessened because of diminished handling of patients.

The premium put upon rest for the patient regardless of his ailment and his previous medical attention is still of paramount importance, even on a modern blitzkreig battlefront. It is agreed that authoritative reference to any treatise on war medicine continually stresses the advances made in the attainment of rest and the prophylaxis of shock, even though the causes are in many instances unknown. In the prevention and therapy of shock and allied conditions as outlined by Blalock, Selge, Dosne, et al., it is even more evident that the simple measures still head the list of any physician's armamentarium.

On the basis of experiments conducted at this detachment it was found that the passenger or cargo compartment will accommodate nine Stokes litters, three in line and three deep athwartship. Each litter is 7 feet in length, 2 feet wide at the shoulders, and 7 inches deep. Twenty inches of space is allowed from the bases of the

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litters to the bottom of the overhead litters. The parallel and adjacent sides of the litters are secured by means of canvas straps already attached to the sides of each litter. This immobilizes them fore and aft and permits easy access to each patient, fore and aft, top or bottom. The ends of each litter are secured to the top of the compartment gunwhale as shown in figure 1.

The advantages of this method of suspension are as follows: There is no infringement on cargo space; no extra equipment is necessary in order to rapidly load or unload the sick or wounded; loading and unloading can be accomplished by a ground crew of two or three stretcher bearers, utilizing the crew of two or three men inside the tractor; the shock-absorbing qualities of the litter are modified by being suspended rather than fixed; the chains can be used athwartship to secure cargo, and when not in use can be secured behind the grab rods inside the compartment; last, but not least, it involves no recommended changes in the present design of the "alligator." The advantages are also applicable to the standard army stretcher which can be substituted for the Stokes litter, or used in combination with them, by forming a chain loop over the ends of each pole.

A RAPID TEST FOR ALBUMIN IN THE URINE

By Lieutenant Commander Raymond H. Goodale, Medical Corps, United States Naval Reserve, and Leslie A. McClintock [1]

A simple test for albumin which does not require the transportation of liquid chemicals is desirable for hospital ships and field hospitals. It seemed probable that the impregnation of filter paper with sulfosalicylic acid would give a means whereby the urine could be filtered and the presence of albumin determined in one step.

This worked satisfactorily, but when the impregnated paper was 2 weeks to 1 month old, it cracked and broke on folding due to the action of the sulfosalicylic acid on the cellulose. This necessitated a modification of the preparation of the paper which would prevent the cracking. Various methods were tried and finally a method of preparation was evolved which has yielded an impregnated filter paper which has lasted more than a year without cracking.

The method of preparation now used is as follows:

A package of one hundred 10 cm. smooth filter papers is dipped into a solution of tartaric acid so that almost half of the paper is impregnated. Then the other half is dipped into a solution of ammonium sulfosalicylate, and they are

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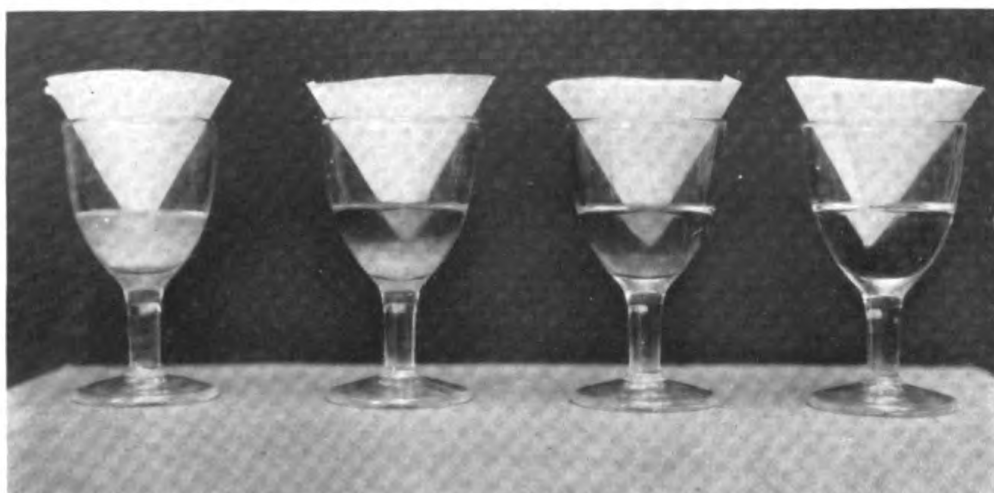
FIGURE 1.—SPECIMENS OF URINE SHOWING VARYING AMOUNTS OF ALBUMIN
FROM LEFT TO RIGHT: HEAVY TRACE, TRACE, SLIGHT TRACE, AND NEGATIVE.

spread out and allowed to dry. (We prepare 2,000 at a time.) The papers are folded in the usual manner and placed in glasses or test tubes.

Each filter cone is filled with about 7 cc. of urine. A reaction takes place between the tartaric ions, which do not form cellulose compounds, and the ammonium sulfosalicylate to form ammonium bitartrate and sulfosalicylic acid. The latter then reacts with the albumin, if present, forming a white soft precipitate.

The amount of precipitate gives a rough estimation of the amount of albumin present (fig. 1). The sensitivity of the test can be increased by increasing the amount of sulfosalicylic acid. According to our method of preparation each paper contains about 150 mgm. of sulfosalicylic acid.

Preparation of reagents:

A half saturated solution of tartaric acid:
Sulfosalicylic acid crystals_____ 300 gms.
Ammonius hydroxide, 26 percent_____ 300 cc.
Distilled water q.s_____ 1,000 cc.

If ammonium hydroxide is thought to be less than 26 percent, it is advisable to add phenolphthalein to the dissolved sulfosalicylic acid and titrate 5 cc. beyond the end point with ammonium hydroxide. This red color does not interfere with the test because it disappears when the papers dry.

DISCUSSION

We find that this method saves time in doing a large number of alubumin tests in urine. There is also no danger of acid burns as in the use of nitric acid.

The filter papers are more easily transported than chemicals, and so this method lends itself for use in Army field laboratories or hospital ships as well as in the doctor's office.

CELLOPHANE COVERSLIPS FOR MICROSCOPIC MOUNTS

By Lieutenant John V. Prevost, Medical Corps, United States Navy

Until the present World War began in September 1939 glass coverslips were imported from Germany, Japan, and England. Early in 1940 the cost of glass coverslips in the United States of America increased from $1.50 to $3.75 an ounce, a figure which became almost prohibitive to the small laboratories. At the present time, regardless of cost, glass coverslips are obtained only with great difficulty.

In 1930 the use of cellophane coverslips for large histologic sections was reported (1). In 1940, Norris (2) suggested the use of

Dupont "Plastacele" as a substitute for glass coverslips in the microscopical examination of urine, feces, and tissue. On a recent cruise, the supply of glass coverslips became exhausted and it therefore was necessary to seek a substitute from materials at hand. Coverslips made from ordinary cellophane wrappers, found on all cigarette packages, proved to be an excellent substitute for glass coverslips in routine microscopic work.

Cellophane coverslips are found to have the following advantages:

1. An unlimited supply is almost universally available at little or no cost.
2. They are unbreakable.
3. If, through an error in technic, the objective lens is brought down forcefully upon the coverslip, the lens is not injured.
4. They may be cut to any size desired.
5. They are more easily applied to the slide without air bubbles forming in the preparation.
6. Thinner preparations with better definition of the microscopic objects are obtained.

It is believed that technicians will find cellophane coverslips more convenient than glass coverslips.

TECHNIC

Excellent darkfield preparations may be made, using cellophane coverships, by the following method:

A glass slide is cleaned and prepared in the usual manner and a loopful of sterile physiological saline is placed in the center of the slide. A loopful of serum from the lesion is then mixed with the saline on the slide. One edge of a square cellophane coverslip, held by a coverslip forceps, is brought into contact with the drop of liquid and the slide. It is held, momentarily, while the liquid become evenly distributed along the edge of the coverslip. Keeping the cellophane in contact with the slide and bending it gently—so that the convexity is toward the slide—it is laid in position flat on the slide. The edges are then sealed by petrolatum which is applied through a 23-gauge hypodermic needle from a 2 cc. syringe. A drop of cedar oil is placed on top of the coverslip and the preparation is ready to be placed on the microscope for examination.

SUMMARY

Cellophane coverslips, made from the cellophane wrappers of cigarette packs have been suggested as a substitute for glass coverslips. A method of using cellophane coverslips for darkfield preparations has been described.

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EMERGENCY TREATMENT OF BURNS

By Lieutenant Commander J. W. Kimbrough, Medical Corps, United States Navy

Experience in modern naval warfare has shown that the treatment of burns occupies a very important position in the handling of casualties. As the immediate treatment of these cases is both necessary and technically difficult, in large numbers, a method of simplification has been sought for and the two following plans evolved.

In the first method the cardboard container of an ordinary 3-inch bandage is carefully opened, so as to avoid tearing, and put aside. The bandage is then placed in a tin container of melted vaseline which has been heated to a waterylike fluidity and left for 15 minutes. At the end of this period it is taken out with forceps and held so that the excess vaseline may drain off. Examination has shown that all parts of the bandage are thoroughly impregnated with a thin film of vaseline. The bandage is then wrapped in doubled waxed paper, by means of which the ends are also carefully covered. The wrapped bandage is now returned to the cardboard container and this is wrapped in muslin, labeled, and autoclaved in the usual manner. This furnishes a surgically clean dressing which may be kept indefinitely in first-aid boxes or dressing stations. It may be used as an ordinary wrap-around bandage in the case of a burned extremity, or placed on a burned area and cut off in suitable lengths.

The second method makes use of a metal box of thin bright tin one thirty-second of an inch thick. This is 3 inches wide, 6 inches long, and 2 inches deep, and equipped with a tight fitting metal cover. In it are placed sections of ordinary 3-inch bandage cut into 12-inch lengths and folded once on themselves. These are alternated with layers of vaseline and when filled the box is covered, wrapped in muslin, labeled, and autoclaved. This furnishes a dressing container which will keep sterile indefinitely and from which 12-inch sections may be removed, under aseptic conditions, without contaminating the rest of the contents.

Both of the above methods have the advantage of furnishing a dressing which will at once cover a burn and lessen shock and at the same time leave a clean lesion, without masses of grease to remove when the burn is redressed. They are easily prepared from material available in any sick bay and, aside from the metal box, no additional expense is involved. We found it possible to have the boxes made aboard ship. It is also felt that this type of dressing will result in an actual saving of both time and material as it will be unnecessary to apply medication to large shell wound dressings.

A PRACTICAL SUGGESTION TO FACILITATE ELECTRODESICCATION

By Lieutenant Folke Becker, Medical Corps, United States Naval Reserve

In the course of electrodesiccation it is often desirable to bring the needle into close contact with tissue, either to decapitate a partially desiccated portion, as in a stage operation, or to assist desiccation by applying mechanical compression. This usually results in the close adherence to the needle of desiccated cells which are not only difficult to remove by wiping with gauze, but seriously impede the process of desiccation.

A simple procedure may be employed which obviates all difficulty and saves much time. A small glass of water is made a standard item on the instrument tray. When sufficient cells become plated on the needle to impair its efficiency, the needle is dipped in the water, without turning off the current, and held immersed for a few seconds. One or two light wipes against a loosely held gauze will then usually leave the needle clear of all debris. The major advantages of this method are:

1. Considerable saving of time and effort in electrodesiccation.
2. Complete removal of debris from needle, with resultant efficient operation throughout.

NOTES AND COMMENTS

THE USE OF SULFONAMIDES IN FIRST AID

The value of the sulfonamides in the prevention of infections in open wounds has been definitely proven. As a consequence their use has been extended to include ordinary first-aid procedures in dealing with wounds. Doctors in this country everywhere are using crystalline sulfanilamide, dusting it into wounds at the place where the accident occurs. Interns and ambulance physicians pour the powder into wounds of accident victims as soon as they are picked up. In other words, the use has been taken from the operating room to the roadside and street. Already the value of this seems to have been demonstrated. Osteomyelitis, for example, which was a more or less common sequel of automobile accidents and severe industrial injuries where the wounds were contaminated with dirt, has been reduced to a minimum. Wounds of the abdominal cavity and even of the brain have been treated by the free use of sulfanilamide powder thrown directly into the wound. There is plenty of evidence that this practice has tremendously reduced infections.

These lessons have not been lost as far as the military surgeon is concerned, and the armies of the world are using sulfanilamide powder as a part of the first-aid equipment of the individual soldier. The wounded soldier himself is being trained to open the package of sulfanilamide and pour it into open wounds. If he is unable to do so, it is done by the litter bearer or a nearby companion. Sulfanilamide has been the drug of choice, as it does not tend to cake as do some of the other sulfonamides when sprinkled into the wound or into a serous cavity.

The still further extension of this first-aid idea to prevent infections is the additional use of the sulfonamides by mouth as a first-aid measure. At present sulfadiazine is the drug of choice. The complete first-aid method here consists, therefore, of dusting the sulfanilamide powder into the wound, following which the wounded man takes sulfadiazine tablets orally, both the powder and tablets being a part of the first-aid package, or issued as a supplement to it.

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SUDDEN COMPRESSION INJURIES OF THE ABDOMEN AT SEA

Breden, d'Abreu, and King, in the January 31, 1942 issue of the British Medical Journal, state that the suction or compression waves set up by detonation waves on land or at sea cause, among other lesions, bleeding into the lungs and abdominal viscera, but since descriptive literature on the lung injuries is extensive, they have devoted their paper to sudden compression injuries of the abdomen. These injuries are similar in their pathology to those which are often observed by hunters where the compression of air from a high velocity projectile, passing close to the victim, kills without leaving any visible outside wound. The killing of fish by explosive charges detonated in the water, the energy waves being transmitted through the liquid, is perhaps a similar phenomenon.

The case histories fell into three groups:

1. Obvious abdominal injuries that recover completely without operation.
2. Severe injuries, such as lacerations, disclosed at operation.
3. Late complications, such as abscess formation.

Immediate fatalities were numerous, but no data were available regarding these. The report deals with survivors from a convoy attacked by submarines, and all were rescued by small ships in which immediate operations such as laparotomies were not possible. Of interest is the fact that there was nothing new to add to the well-known principles which enables the surgeon to decide whether he should operate or not in these abdominal injuries.

The immediate symptoms after compression were not severe and there was no external bruising in any patient. Pain in the testicle was common to all three classes.

In group 1 the authors state that hematemesis, melena, abdominal pain, hiccups, and a rigid abdomen were the prominent symptoms, but always with recovery.

Those in group 2 were found to have the most serious injuries. Coughing, abdominal pain and rigidity, and blood in stools were the prominent symptoms. All required surgery, and on exploration, the usual findings were lacerations of the ilium, with hemorrhages of the subperitoneal tissues, and spreading peritonitis.

Group 3 included the injured who survived what were severe original compression injuries, treated by conservative measures, but who later developed localized abscesses. He gives two case histories, one who developed a pelvic abscess and the other a subphrenic abscess, both 9 days after the injury. Both cases required drainage; convalescence was uneventful.

The authors conclude that their results justify the adoption of conservative management of these patients, especially if seen after 24 hours.

TROPICAL MEDICINE

There was very little interest, in the United States, in the subject of tropical medicine until after the Spanish-American War of 1898. Then the widespread character of naval and military operations in tropical areas such as the West Indies, Guam, and the Philippines drew immediate attention to the subject. It was natural, too, that medical officers of the Army, Navy, and Public Health Service should be the first to come in contact with the problems of tropical medicine and tropical hygiene, and be the pioneers in the subject in the United States.

In the case of the Navy, the necessity of furnishing medical care to the civilian population of Guam and Samoa and work with expeditionary forces in connection with the surveying and construction of the Panama Canal led to extensive experience with tropical disease conditions in various parts of the world. Dr. Welch, of Johns Hopkins Medical School, recommended to Surgeon General Rixey, that he send several of his medical officers to one of the British schools of tropical medicine, emphasizing the importance of previous practical training in bacteriology and medical zoology of those selected. It is not surprising, therefore, that the Medical Corps of the Navy produced a number of men who were outstanding specialists in the subject, and that the Naval Medical School, a postgraduate school of naval medicine established in Washington in 1902, became, perhaps, the leading center of teaching in tropical medicine in this country for a quarter of a century.

Many medical schools have since given prominence to the subject and the relative position of the Naval Medical School has consequently much declined. Tropical medicine became a less common specialty among members of the Medical Corps and the whole subject may be said to have suffered an eclipse in popularity. With the recent acquisition, however, of numerous Caribbean bases and the world-wide character of the present war, the need for knowledge of tropical medicine is again obvious, and it is probable that there will be a renewed interest in the subject in the Medical Corps of the Navy.

HONORARY MEDICAL CONSULTANTS

During the first World War, a number of prominent civilian medical men gave their services free as honorary consultants for the Medical Departments of the Army and Navy. In the present war, upon the recommendation of the Surgeon General and the Secretary of the Navy, the President has appointed a group of outstanding physicians as honorary consultants to the Surgeon General of the Navy. These include:

Dr. Donald Church Balfour, director, Mayo Foundation, Rochester, Minn.; Dr. George Washington Crile, director, Cleveland Clinic Foundation and Cleveland Hospital, Cleveland, Ohio; Dr. Walter Edward Dandy, professor of neurosurgery, Johns Hopkins Medical School, Baltimore, Md.; Dr. Frank H. Lahey, director of Lahey Clinic and president of the American Medical Association; Dr. Willis B. Morse, an eminent surgeon of Salem, Oreg.; Dr. Wilbur Augustus Sawyer, director of the international health division of the Rockefeller Foundation; Dr. Meyer Wiener, professor of clinical ophthalmology, Washington University of Medicine, St. Louis, Mo.; and Dr. Oswald S. Lowsley, an eminent urologist of New York City.

THE ARMY IDENTIFICATION TAG

Although there have been notices of identification tags worn by the Army in the public press, a description of this tag and a comparison with that used by the Navy may be of interest to naval medical officers.

The identification tag worn in the Army varies considerably from that worn in the Navy.

That of the Navy consists of a plate of Monel metal, $1\frac{1}{4}$x$1\frac{1}{2}$ inches, perforated at both ends allowing for either suspension from the neck or to be worn about the wrist. The individual's initials and surname; service number; date of tetanus toxoid; blood group; and the letters *U. S. N.*, *U. S. N. R.*, or *U. S. M. C.*, depending upon the branch of the naval service, are stamped on one side. The rolled print of the right index finger is etched on the other side.

The new Army tag, also made of Monel metal, is 2 inches long and $1\frac{1}{2}$ inches wide. This tag contains additional personal history in comparison with the old Army tag and the present Navy one. The model adopted in 1917 was about the size of a half dollar and was stamped only with the enlisted man's name and the letters *U. S. A.* on one side and his Army serial number on the other. The new tag provides additional personal history, such as blood type, name and address of nearest relative, a record of tetanus vaccination, and owner's religion. The Army tag does not contain the individual's fingerprint.

VACCINATION AGAINST TYPHUS AND CHOLERA

All officers and men sent to regions of the world where louse-borne typhus and Asiatic cholera are present will be vaccinated against these diseases. Louse-borne typhus is now present in Spain, Rumania, Poland, Russia, and the Mediterranean coast of North Africa in epidemic proportions. Asiatic cholera is still prevalent

in the Orient, Africa, and along the Mediterranean coast. Vaccinations will be done in the field and aboard ship, and the date of vaccination will be entered in the health record.

At the present time there are a number of typhus vaccines in use, most of them having been developed in Europe. The results with the various vaccines cannot be compared accurately because in most instances no accurate statistics of the results were kept. Many of the European vaccines have a high incidence of reactions.

In this country the type known as the Cox vaccine will be used to vaccinate our officers and men. It has the advantage over the other types in use in that it is relatively simple to make, can be made in large quantities in a very short time, and can be kept at room temperature. This vaccine is made by inoculating chick embryos with the rickettsiae of epidemic (louse-borne) typhus. Out of 16,000 vaccinations against typhus, recently administered in Bolivia, there has not been a single record of any case of reaction.

Typhus caused by the rat flea is known as the flea-borne, New World, or endemic type. In some cases, the New World type may be transmitted by the tick, although this is probably rare. American typhus occasionally occurs from Virginia to Texas, and is more common in the Southern States, and particularly among males whose occupation carries them into rat-infested areas. This type of typhus has a low mortality and a definite immunity develops.

It might be well to mention Brill's disease which has occurred to date only in Boston and New York, and among the Hebrew race, especially refugees from typhus areas in Europe. It is often confused with the endemic or New World type, but there is no relation as each has its specific test. There are indications that these cases are relapses from the epidemic type of typhus. The mortality is low, but there is considerable disability as the symptoms tend to assume a chronic character.

Navy personnel going to parts of the world where cholera is prevalent will be vaccinated against this disease. Recently, the dose of cholera vaccine was stepped up from 300 million per cc. to 800 million per cc., the latter being the dose the British were using in India and which appears to be more efficacious. Based on experience in the Far East, it is necessary to obtain cholera organisms early in an epidemic in order to produce a vaccine which gives a high antibody response. Since 1920 there have been only two cases of death due to cholera in the United States Navy.

It is important to emphasize that typhus or cholera vaccination does not result in absolute protection against those diseases in the same sense as cowpox vaccination. Other methods of control must be stressed in the face of an epidemic, and high standards of sanitation and hygiene must be maintained.

SOME PSYCHOLOGICAL EFFECTS OF AIR RAIDS

During the latter part of 1941, Dr. Robert D. Gillespie, an eminent British psychologist who was attached to the Royal Air Force, delivered a series of lectures in America in which he gave an account of the psychological effects of air raids—particularly upon civilians. He also, however, gave some results of observations on military men. Some of the conclusions which have been arrived at after nearly 2 years of war are most interesting.

One of the first conclusions is that there are remarkably few psychoneuroses among the members of aviation forces despite the severe strain of aerial warfare. Another result of interest is that mental break-downs among civilians in bombed cities were unusually few. Another striking feature was the fact that, in general, children were less affected than was anticipated. In this connection Dr. Gillespie pointed out that children generally follow the pattern of behavior of adults.

He, as well as other psychologists, has emphasized the prophylactic value and importance of having people kept busy and occupied in time of stress and danger. One of the greatest benefits of the organization for defense of civilians in a community which may be subjected to bombing, is that by giving them various specific tasks to perform in a time of emergency, their courage and morale is maintained. Occupation is also, apparently, an important preventive measure against the development of the various psychoneuroses which might be expected to result from the fear and strain to which a population under air attack is subjected.

THE HISTORY OF POISONS USED AS WAR WEAPONS

"The tremendous effect of poison on the unprepared was always a chief reason why warring powers have been using poisoned weapons since the dark days of antiquity," says Dr. Waldemar Schweishmere in his article, "Poisons as War Weapons in History," that appeared in the September 3, 1941, issue of the Medical Record. Since prehistoric times arrow poisons have been used for hunting as well as fighting. Celts, Gauls, Franks, and Vandals, all used poisoned weapons. We do not know with certainty what kind of plant and animal poisons were used by the Dacians and the Dalmatians in the Balkans. Among the Goths, poisons seem to have been a common weapon.

The poisons used by the various tribes of Bushmen of Africa in their fights vary remarkably. Livingstone stated that those who inhabited the Kalahari district used the entrals of a small caterpillar for poisoning their spears and arrows. When drawn over

a sore, this insect, which is known to the natives as "Nga," caused violent pain, and those wounded by arrows smeared with this poison died slowly in a condition of delirium.

The terror of living venomous snakes has also been used in warfare. Hannibal once gained a naval battle when he had venomous snakes collected, locked up in earthen vessels and thrown on the enemy ship during the battle. The enemies at first thought it ridiculous to fight with earthen vessels, but they became panicky when the snakes crawled over the deck, and Hannibal gained an easy victory.

The poisoning of whole tribes and armies by various means was not an unusual method of gaining victory. History tells us of a war ruse applied by the Carthaginian General Maharbal about 200 B. C. He had been sent against some African tribes who were fond of drink. After the first battle, he feigned retreat, leaving a large amount of wine mixed with mandragora in his camp. The Africans drank of this, fell in a narcotic sleep, and were attacked and killed at night.

Lewin tells of a successful mass poisoning in the war between Duncan, King of Scots, and the Danish king Swen who landed in the eleventh century in Scotland in order to add this country to his own state. During negotiations the Scots brought plenty of bread and wine and an alcoholic, beerlike beverage. To this they had added the juice, seed, and root of a poisonous plant, "Solanum somniferum," which grew in many places in Scotland. The unsuspecting Danish soldiers emptied large bowls of the beverage. As soon as scouts told the king that the Danish soldiers were in deep sleep, the king sent his troops into the enemy camp and most of the Danes were killed without being able to resist.

For many centuries poisoning of drinking water was considered an effective weapon in the attack on a besieged town or island. The most ancient experience with this kind of successful poisoning has been related by Pausanias, a noted Greek writer of the second century A. D. According to his story, Solon, Athenian statesman and reformer, besieged the Greek community of Kirrha, or Krissa, about 600 B. C. The small river Pleisthenes flowed through the town in the form of a canal and supplied it with drinking water. Solon drained the river off, and the besieged army was compelled to rely on the small amount of rain water. Solon ordered many roots of Helleborus (which grew plentifully and in good capacity in the surroundings) thrown into the water of the river, and when he believed that enough poison had been extracted, he sent the water again into the town canal. The town soldiers, happy about the regained water, drank as much as they could. This resulted in violent and continuous attacks of diarrhea and prostration, and the town was captured.

When firearms had been invented, arsenic and other poisons were often added to bullets.

The modern gas bomb with its load of poisonous gases has a predecessor in the "Greek fire" of the ancient armies. The recipe for this "fire" was strictly guarded as a state secret in Byzantium and it succeeded in being kept secret for four centuries. At last the Mohammedans learned how to prepare it themselves. This fire was capable of developing an intense, heavy smoke which contained a large amount of fatal carbon monoxide. At the siege of Akkon in 1289, the Sultan had Greek fire bombs continuously thrown into the city by 300 machines, and many persons were suffocated by the carbon monoxide in the smoke.

The first extensive gas attack was delivered with chlorine gas by the Germans against the Allies, north of Ypres on April 22, 1915. Thousands of cylinders of liquefied chlorine were installed over a 6-kilometer front. A favorable wind swept the gigantic, suffocating cloud for several miles before the gas was finally dissipated. The Allied casualties were between 5,000 and 20,000, according to different sources.

The cylinder gas attack soon gave way to the use of projectiles to release poisonous chemicals directly upon the target. Chlorine was soon superseded by more dangerous gases.

Since ancient times, therefore, when arrow poison, as a chemical agent, was first used for hunting as well as for fighting, highly scientific methods of killing by poisonous agents (gases) have developed. From chlorine gas, first used for mass killings, there have appeared numerous chemical lung irritants, lacrimators, sternutators, and vesicants. Incendiary bombs, which combine both thermite and poisonous gases, have also been developed and the ingenuity of the chemist will no doubt produce other types.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,
UNITED STATES NAVAL MEDICAL BULLETIN,
    Bureau of Medicine and Surgery, Navy Department,
      Washington, D. C.

(For review)

STITT'S DIAGNOSIS, PREVENTION AND TREATMENT OF TROPICAL DISEASES, by *Richard P. Strong, M. D., Sc. D., D. S. M., C. B., Professor of Tropical Medicine, Emeritus, Harvard University; Consultant to the Secretary of War on Tropical Medicine, 1941*. Sixth edition, two volumes, 1,826 pages with 398 illustrations. The Blakiston Co., Philadelphia, Pa., publishers, 1942. Price $21 per set.

The sixth edition of this well-known and much used text and reference book on tropical diseases has grown into two volumes since the last edition. It has been thoroughly revised and the text greatly expanded by Dr. Richard P. Strong, who has. used many authorities freely in modernizing the treatise.

In particular, one discovers extensive additions to the chapters on amebiasis, nutritional diseases, heat stroke, tropical hygiene, and to various sections dealing with helminths. Due to a revision by Dr. A. W. Sellards, the chapter on yellow fever has been brought up to date and there have been revisions in those concerned with medical entomology. There is, in particular, new material in the chapter on dengue fever, and references to new drugs and their specific use in tropical diseases.

The illustrations added have all been carefully selected and are as good as, or better than, those previously used, which have been considered excellent. The new edition will undoubtedly meet with general favor and will find welcome on the shelves of both public and private libraries. The novelty of having a complete index in each volume will meet with general approval.

THE TREATMENT OF BURNS, by *Henry N. Harkins, M. S., M. D., Ph. D., F. A. C. S., Associate Surgeon, Henry Ford Hospital, Detroit*. 457 pages, illustrated. Charles C. Thomas, Springfield, Ill., publisher, 1942. Price $6.50.

This is, without doubt, one of the best written and most complete work on burns ever published. The book varies considerably from the usual form of scientific book in that the reading never becomes dull. The author stresses the importance of the history of burns by introducing each chapter with an historical résumé and if the contributor is well known, he gives his biography as well as his photograph. For example, the biographies and photographs of such men as Dupuytren, Underhill and Curling, and others, all of whom have done pioneer work in the field of burns, are given. Of equal interest are quotations of world authorities given at the head of each chapter, all in their original form either in German, French, or English.

The book is divided into four parts. Part I discusses the etiology, classification, pathology, chemical changes, hemoconcentration, shock, and the role of the various infections and complications of burns. Part II describes the various treatments for burns and under general treatment points out the treatment for shock and toxemia. Further on, the local treatment is discussed, using the various tanning methods, dyes, baths, and antiseptics. Part III describes special burns, such as electrical and chemical; and Part IV is a practical outline of treatment. Here the first-aid treatment for burns in the home is described, as well as the first-aid home treatment recommended to physicians.

Throughout the book the author points out the rationale of treating burns and correlates the etiology and pathology with the treatment. The author has acquired the views and practices of the foremost world authorities on burns and has given an impartial and exhaustive study on this subject.

The book contains 1,320 indexed references. There are 457 pages printed on good quality nonglossy paper. The size of the type makes it easy reading. The illustrations are clear and the tables are short and few. This book is recommended to every library for its references, and to every doctor interested in the treatment of burns.

SURGERY OF THE AMBULATORY PATIENT, by *L. Kraeer Ferguson, A. B., M. D., F. A. C. S., Lieutenant Commander, Medical Corps, U. S. N. R.; Assistant Professor of Surgery, University of Pennsylvania; with a section on fractures by Louis Kaplan, A. B., M. D., F. A. C. S., Associate in Surgery, University of Pennsylvania.* 923 pages with 645 illustrations. J. B. Lippincott Company, Philadelphia, Pa., publishers, 1942. Price $10.

It has been the reviewer's experience that most surgery textbooks are prone to let major surgery dominate the text, while ambulatory surgery is held in the background, either due to the lack of space or to the author, whose specialized surgery has taken him away from the importance of ambulatory surgery.

The book is divided into three parts. Part I discusses generally typical lesions giving a description of their cause, course, and care. Anesthesia, pre-operative and post-operative care are also discussed. Part II deals with the regional surgical lesions such as the scalp, face, mouth, neck, etc., and gives the method of treatment. Part III contains the treatment of fractures and dislocations of ambulatory patients.

This book is important in that the author does not waste words in describing the various lesions and gets to the point immediately. The many technics described are clear, concise, and illustrated in such a manner that the young surgeon or general practitioner can understand them without difficulty.

The chapter on local anesthesia is particularly good in that the technic described is well illustrated and it can be used in everyday practice. It illustrates "the tricks" in getting good anesthesia for the various field and nerve blocks, and one doing office rectal surgery would profit on the methods of obtaining good rectal anesthesia.

The technic of rectal surgery is described in such a manner as to make the various operations simple and easy. The author points out the successful methods in treating carbuncles, furuncles, the removal of cysts, the treatment of ganglia, bursa, and the lesions about the face and body. Reduction of simple fractures and dislocations as an office procedure is recommended.

There are 29 chapters and each chapter contains a large bibliography. The illustrations and sketches number 645, and there are 923 pages. The paper is of excellent quality and the print is such that it makes easy reading. This is a "must" for every library and for every surgeon, whether he be a specialist or a general practitioner.

SKIN GRAFTING, From a Personal and Experimental Viewpoint, by *Earl Calvin Padgett, M. D., F. A. C. S., Professor of Clinical Surgery, University of Kansas School of Medicine, Kansas City, Kansas.* 149 pages, 160 illustrations on 65 figures. Charles C. Thomas, Springfield, Ill., publishers, 1942. Price $4.50.

The author has, in this book, presented the subject of skin grafting from the standpoint of his clinical experience and in conjunction with certain experimental work.

He gives a brief chronological review of skin grafting and in the chapter describing his experimental work, he points out that homogenous skin grafting is not practical except in identical twins.

Of importance are the chapters dealing with the various types of skin grafts, the indications for each, and the various methods and technics for cutting these grafts. He describes the various anatomical sites where grafting is done and where rebuilding of epithelial tubes is necessary. Pre-operative and post-operative care are also stressed. Of interest to the reviewer was the chapter describing the method of cutting grafts with the dermatome, a simple machine that lifts the grafts and cuts them mechanically to any thickness.

The book is well illustrated and well written, and is recommended for the surgeon's library.

A HAND-BOOK OF OCULAR THERAPEUTICS, by *Sanford R. Gifford, M. A., M. D., F. A. C. S., Professor of Ophthalmology, Northwestern University, Chicago, Ill.* Third edition, thoroughly revised, 410 pages illustrated with 69 engravings. Lea & Febiger, Philadelphia, Pa., publishers, 1942. Price $4.

This is a small and handy book on the eye dealing entirely with treatment, although there are brief notes on the etiology and symptoms of the important diseases of the eye. It is of special interest because it contains the latest knowledge in regard to the use of sulfanilamide and its derivatives, and its references to sympathomimetic and parasympathomimetic drugs are particularly interesting. The relation of nutrition to eye diseases is also up to the minute. The latest in therapeutics and conciseness are the outstanding characteristics of this book.

NEUROANATOMY, by *Fred A. Mettler, A. M., M. D., Ph. D., Professor of Anatomy, University of Georgia School of Medicine, Augusta, Georgia.* 476 pages with 337 illustrations, including 30 in color. The C. V. Mosby Co., St. Louis, Mo., publishers, 1942. Price $7.50.

This is a medium size and beautifully illustrated manual and atlas of neuroanatomy, fully adequate for the anatomist and the neurosurgeon. An interesting feature is 54 pages of general references grouped at the back of the book and providing collateral reading on every subject covered in the text.

A TEXTBOOK OF PATHOLOGY, edited by *E. T. Bell, M. D., Professor of Pathology in the University of Minnesota, Minneapolis, Minnesota.* Fourth edition, enlarged and thoroughly revised. 931 pages, illustrated with 431 engravings and 2 colored plates. Lea and Febiger, Philadelphia, Pa., publishers. Price $9.50.

The arrangement of the fourth edition is orderly and well conceived. The subject matter is concise, clear and presented in such a manner that it is easy to read and understand. Numerous references are given immediately following each subject.

The figures illustrating gross and microscopical pathology are well arranged and demonstrate very clearly the pathological conditions discussed. There are two excellent colored plates in the chapter "Diseases of the Blood" showing normal and pathological blood cells.

It is the opinion of the reviewer that this book is an excellent reference text.

MANUAL OF CLINICAL CHEMISTRY, by *Miriam Reiner, M. Sc., Assistant Chemist to The Mount Sinai Hospital, New York.* Introduction by *Harry Sobotka, Ph. D., Chemist to The Mount Sinai Hospital, New York.* 296 pages with 18 illustrations. Interscience Publishers, Inc., New York, 1941. Price $3.

This small manual of clinical chemistry gives the technic for performing the various tests required of the average clinical chemistry

laboratory. The tests, as well as the methods for preparing the reagents and standard solutions, are written in an accurate, concise manner. Every well-established clinical laboratory selects methods which are particularly adaptable to that laboratory; however, the tests outlined in this manual are well suited for the average clinical laboratory. Every intern and laboratory technician will find this pocket manual extremely helpful.

GYNECOLOGY AND FEMALE ENDOCRINOLOGY, by *Emil Novak, A. B., M. D., D. Sc. (Hon. Dublin), F. A. C. S., Associate in Gynecology, The Johns Hopkins Medical School.* 605 pages, illustrated. Little, Brown and Co., Boston, Mass., publishers, 1941. Price $10.

This book is intended for the use of the general practitioner, and for the medical student. The author's discussion of the anatomy is terse but adequate. His discussion of the pathological aspects of gynecological diseases is comprehensive and well illustrated by pictures of the gross and microscopical changes. This is a great advance in the presentation of the subject.

The chapters on the various endocrine disorders, the underlying physiology, and the rationale of endocrine therapy, are a scholarly presentation of the subject. The bibliography is extensive and the index arranged for ready reference. The binding is sturdy and the type clear and easy to read.

A TEXTBOOK OF NEURO-ANATOMY, by *Albert Kuntz, Ph. D., M. D., Professor of Micro-anatomy in St. Louis University School of Medicine.* Third edition, thoroughly revised, 518 pages, illustrated with 307 engravings. Lea & Febiger, Philadelphia, Pa., publishers, 1942. Price $6.

This book is the third edition. The author is well known in his field and in revising this edition he has tried to reduce to a minimum the difficulties which the student encounters in the study of anatomy and physiology of the nervous system.

The first few chapters give the student a good introduction and working knowledge of the human nervous system without unnecessary details that are so often found in this type of book. The remaining chapters deal with reflexes, conduction pathways, the various anatomical parts of the brain and their functions, etc.

The book is well illustrated, and some illustrations have been replaced with new ones. Parts of the book have been rewritten, but without increasing the material.

There are 26 chapters, and at the end of each chapter is a summary of the material and its important points. This should prove valuable to the student when reviewing his neuro-anatomy. The last chapter contains a laboratory outline. The pages are glossy, the type large and easily read, and the book is well indexed.

TREATMENT OF THE PATIENT PAST FIFTY, by *Ernst P. Boas, M. D., Associate Physician, Mount Sinai Hospital, New York City.* 324 pages, illustrated. The Year Book Publishers, Inc., Chicago, Ill., publishers, 1941. Price $4.

It is well known to medical men that the lowering of mortality and the lengthening of the average span of life has been due entirely to the success of preventive medicine in dealing with the diseases of childhood. The death rate from diphtheria, scarlet fever, typhoid, childhood tuberculosis, and similar conditions has been lessened, but little or no change has been made in the incidence of disease of middle and later life. As a consequence, a child has a much better chance of living to adult age now than before, but the person of 40 has no assurance of living beyond the span allotted by the psalmist of "three score years and ten."

It is time that research and study should be now directed to this field of preventive medicine, and it is significant that the science of geriatrics has been heard of more and more in recent years and more books are appearing on the subject. This one is excellent and is intended as a clinical guide in treating the older patient.

SYMPTOM DIAGNOSIS, Regional and General, by *Wallace Mason Yater, A. B., M. D., M. S. (in Med.), F. A. C. P., Professor of Medicine and Director of the Department of Medicine, Georgetown University School of Medicine.* Originally written by *the late Wilfred M. Barton, A. M., M. D., F. A. C. P.,* and *Wallace M. Yater, A. B., M. D., M. S. (in Med.), F. A. C. P.* Fourth edition, 900 pages. D. Appleton-Century Co., Inc., New York, N. Y., publishers, 1942. Price $10.

This is a very fine book, fine in appearance and printing, and full of valuable information. It constitutes a kind of dictionary of diagnoses. The arrangement is practical and designed for ready reference and the main facts about the symptoms and signs of a disease may be obtained at once without wading through a mass of qualifying matter.

IMMUNOLOGY, by *Nobel Pierce Sherwood, Ph. D., M. D., F. A. C. P., Professor of Bacteriology, University of Kansas, and Pathologist to the Lawrence Memorial Hospital, Lawrence, Kansas.* 639 pages, illustrated, second edition. The C. V. Mosby Co., St. Louis, Mo., publishers, 1941. Price $6.50.

This book was originally written for the use of medical students in teaching the fundamentals of immunology. It is well arranged and liberally supplied with definitions, without which the beginner is greatly handicapped when he attempts supplementary reading of the literature of this branch of medical science. It will be of value in the clinical laboratory and to those laboratory workers who are called upon to perform immunological procedures in connection with their routine duties.

The entire field is well covered and accepted standard procedures are given, analyzed and discussed. Medical officers and others whose

interest in the subject is deeper and more extensive will find the bibliography of considerable value.

ALLERGY IN CLINICAL PRACTICE, by *Staff Members of the Cleveland Clinic; under the direction of Russell L. Haden, M. D., F. A. C. P., Chief of the Medical Division;* edited by *J. Warrick Thomas, M. D., F. A. C. P., Chief of the Section on Allergy.* 354 pages with 92 illustrations including 14 subjects in color. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1941. Price $5.

This book is a well thought-out and executed presentation of the practical aspects of allergy. There is little in the book that is new to the allergist or to the specialist in internal medicine, dermatology, otorhinolaryngology or other fields. However, the material presented is a valuable reminder to any practicing physician of the various complaints, symptoms, and physical findings which may be caused by his patient's altered sensitivity to certain substances which cause minimal or no symptoms in other individuals.

The authors attempt to bridge the gap between the allergist and the general practitioner or the allergist and the specialist in other clinical fields. They stress the necessity of cooperation and mutual consultations in order to arrive at correct diagnoses and proper therapy.

Pertinent case histories with an outline of the allergic study and management and brief comments on each case conclude the chapters on each of the many subjects.

These features make the book a brief and practical guide intended primarily for the general practitioner who, as the authors state, must "diagnose and treat the more obvious manifestations of allergy such as hay fever, migraine, atopic dermatitis, etc., referring to the allergist only those cases which require specialized investigations and treatment."

FOOD AND BEVERAGE ANALYSES, by *Milton A. Bridges, B. S., M. D., F. A. C. P., Late Assistant Clinical Professor of Medicine and Lecturer in Therapeutics, New York Postgraduate Medical School, Columbia University;* and *Marjorie R. Mattice, A. B., M. S., Assistant Professor of Pathological Chemistry, Department of Medicine, New York Postgraduate Medical School, Columbia University.* Second edition, revised, 344 pages. Lea & Febiger, Philadelphia, Pa., publishers, 1942. Price $4.

The title of this book must be looked at carefully to understand what the book contains. It is "Food and Beverage Analyses" and not "Food and Beverage Analysis"; in other words, this is a handbook showing the contents of foods and beverages by careful analyses and is not a laboratory text giving the technic of food and beverage analysis. It is an extremely valuable collection of tables together with a certain amount of text which furnishes an authoritative reference for the clinician or the physiologist with information on the content of each food. An interesting feature is the size of the portion expressed both in grams and in common household measures.

Among the valuable tables are those on acidity of food, purine and fiber content and metabolic reaction. The section on vitamins contains the latest information and there is an interesting glossary of vitamin terms. Another interesting feature is the section giving the analyses and characteristics of various alcoholic beverages.

This is the second edition, and Dr. Bridges, unfortunately, died during its preparation, but Professor Mattice has completed the revision in an excellent manner. The writer reviewed the first edition of this book in the United States Naval Medical Bulletin and then drew attention to the foreword—a foreword so apt for a book of this character that it is repeated here: "Now go, write it before them in a table, and note it in a book, that it may be for the time to come for ever and ever." Isaiah 30 : 8.

THE 1941 YEAR BOOK OF INDUSTRIAL AND ORTHOPEDIC SURGERY, edited by *Charles F. Painter, M. D., Orthopedic Surgeon to the Massachusetts Women's Hospital and Beth Israel Hospital, Boston*. 432 pages, illustrated. The Year Book Publishers, Inc., Chicago, Ill., publishers, 1941. Price $3.

As usual this year book contains the latest advances in industrial and orthopedic surgery. The authors are outstanding in the field of orthopedics and industrial medicine. The latest advances in the treatment of industrial injuries are described. One notices more and more the importance of these types of injuries and the growing specialty of industrial surgery. It is well printed, well illustrated, and well indexed. For those interested in the latest treatment of industrial and orthopedic surgery, this book is recommended.

A TEXTBOOK OF STERILIZATION by *Weeden B. Underwood, B. S. in E. E., Director of Research, American Sterilizer Company, Erie, Pennsylvania*. 172 pages, illustrated, 2nd edition. The Lakeside Press, R. R. Donnelley & Sons Co., Chicago, Ill., publishers. Price $3.

This is a very useful reference book which should be in the hands of every operating room supervisor. It has been revised since the last printing and somewhat enlarged. The chapter on "Sanitary Protective Features" is particularly timely and contains information not generally available or known to hospital superintendents.

CLINICAL HEMATOLOGY by *Maxwell M. Wintrobe, M. D., Ph. D., Associate in Medicine, Johns Hopkins University*. 792 pages illustrated with 167 engravings and 7 colored plates. Lea & Febiger, Philadelphia, Pa., publishers. Price $10.

This is the best one-volume hematology the reviewer has seen for a long time. In size it forms a happy medium between the small manual with not enough information and the voluminous atlas with too much for anyone but the research worker. Although not an atlas, the illustrations are outstanding for their excellence. For the average doctor and general practitioner it is an ideal book on the subject.

THE DIVISION OF PREVENTIVE MEDICINE

Captain C. S. Stephenson, Medical Corps, United States Navy, in charge

A PLAN FOR THE CONTROL OF POTENTIALLY HAZARDOUS SUBSTANCES USED IN A NAVY YARD [1]

By Lieutenant Commander L. J. Goldwater, Medical Corps, United States Naval Reserve, and Lieutenant C. P. Jeffers, Medical Corps, United States Navy

Obviously the first step in planning for the safe usage of potentially harmful substances in any industrial organization is to find out what materials are used, where and how they are used, and in what amounts. When the Industrial Health Office was established in the New York Navy Yard, it was at once realized that obtaining this essential information presented a problem of no small magnitude. In order to obviate any haphazard search for the essential data, the method to be described was devised, and it was felt that a similar approach could be used in many, if not all, of the other naval shore stations where industrial work is done.

Investigation revealed that with the exception of a few sundry purchases, all materials used come through the Supply Department. This activity maintains a comprehensive catalogue complete with index for all items used in the yard. For each item there is a card on which is entered the number of each shop using the particular material, together with dates and quantities requisitioned.

With the cooperation of the Supply Department personnel, the files containing information as to the nature of substances and the shops in which they are used were carefully reviewed, and any materials which were considered potentially harmful were listed and cross-indexed. The shops using any of the potentially injurious substances were listed; a card was prepared for each material showing the shops where it was used; and finally a card was made for each shop showing the article used. As an example, it was found that benzol was used in Shops 01, 09, 31, 36, 38, 51, 79, and 122, and the cross-index cards showed that benzol was among the hazardous materials handled in each of these shops. The class numbers of the Classification Index of the Navy Department Standard Stock Catalogue are used on the cards. By using this cataloguing system, it is

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[1] Navy Yard, New York, N. Y.

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possible, in the great majority of instances, to find in a few moments just what one is dealing with in the nature of possibly harmful substances. There are, however, some products which are listed by name only and while they meet certain conditions prescribed by a Navy specification, no mention is made of the constituents. This is particularly true of specifications in the general category of "compounds." In such cases, it has been found that the manufacturers are usually willing to supply information as to ingredients, it being unnecessary to disclose the exact formula.

In compiling these data, a great many items which were capable of producing industrial illnesses were revealed which would probably have escaped attention by any other survey method.

A valuable additional source of information is to be found in the bulletin "Instructions for Painting and Cementing Vessels of the United States Navy." This bulletin was prepared under the supervision of the Bureau of Ships and gives formulas and specifications for various paints and cements used by the Navy.

The problem of sundry purchase items has created some difficulty in keeping track of all materials; however, special transactions are relatively few in number since this method is used only in case of an emergency. Furthermore, it is possible to check all open purchases through the Office of the Material Superintendent and thus obtain the desired information regarding products capable of being injurious to health.

It is acknowledged that the above described method is not new in the field of industrial medicine. It is, however, considered a valuable means of identification and control of potentially hazardous materials, and it is thought that such a scheme might well be brought to the attention of naval medical officers engaged in industrial hygiene at this time.

HEMORRHAGE, TRAUMATIC, INTESTINAL TRACT, U. S. A. "SPICA"

By Lieutenant, junior grade, R. V. Hill, Medical Corps, United States Navy

The cases of hemorrhage, traumatic, intestinal tract, which occurred on board the U. S. S. Spica on December 22, 23, 27, and 28, respectively, are of unusual interest from the standpoint of medicine as well as for general information. The disease was characterized by the sudden onset of dizziness, weakness, and collapse, with no apparent reason either by history or physical examination. It appeared as though a new and strange malady had struck the ship, until the source of the cause was found to be a faulty can opener which caused small, sharp-edged pieces of tin to fall into the food of an opened can. One of the patients hemorrhaged so severely by bowel that he went into almost complete circulatory collapse.

The following case summaries, with contributing factors and events, are presented in the order in which they occurred:

CASE 1

Syncope.—A gunner's mate, third class, age 22, on 12–22–41 while telephoning on the forecastle, became dizzy and fainted, falling on his face, resulting in a minor abrasion over his right eye. He soon regained consciousness and was brought to the sick bay. He had had no similar previous attacks.

Examination revealed the usual findings of a peripheral circulatory collapse, that is, pallor, rapid, feeble pulse, blood pressure of 90/50, and a cold, clammy skin. Aside from this and the abrasion over his eye the examination was entirely negative, including a neurological.

Treatment consisted of bed rest and observation.

On 12–24–41 the patient was still a little weak and pale but subjectively greatly improved. On 12–26–41 he was sent to light duty under observation. No further symptoms developed, but on 12–28–41, when pieces of metal were found in the food, and because of the presence of three more similar cases, it was deemed advisable to run occult blood tests on the stools of these cases with syncope.[1] A very strongly positive was obtained in this case, as in all of the others, so the diagnosis was then changed from syncope to hemorrhage, traumatic, intestinal tract. No new treatment was instituted and the patient has remained well.

CASE 2

Syncope.—A fireman, first class, age 26, on 12–23–41 while on watch in the fireroom, became dizzy, fainted, and fell forward on his face, causing minor lacerations over his left eyebrow and on his upper lip. He soon regained consciousness and was brought to the sick bay.

Examination revealed the same findings as those of Case 1, that is, pallor, cold, clammy skin, feeble and rapid pulse with a blood pressure of 90/50. Neurological examination was negative.

Treatment was bed rest and observation.

On 12–24–41 the patient's stools were examined for occult blood, and found to be strongly positive. In lieu of this and other evidence the diagnosis was changed to hemorrhage, traumatic, intestinal tract, as in Case 1.

CASE 3

Diagnosis Undetermined, Ulcer, duodenal.—On 12–27–41, a ship's cook, second class, age 21, while on duty in the galley, suddenly became dizzy and weak, broke out in a profuse perspiration, and vomited a large amount of red blood (approximately 2 cupfuls). On questioning it was found that he had been passing black, tarry stools for the past 4 days, but aside from this he gave no typical history of an ulcer case. There was no family history, he did not drink or smoke, he had never suffered from dyspepsia in any form, and he had never had any pain in his abdomen following meals.

Examination revealed the signs of acute circulatory collapse, as in the other cases, but in this case the reason was obvious, namely, hemorrhage. It is noteworthy that there was no abdominal tenderness or pain, and with the

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[1] The occult blood test used in these cases was the benzedrine-peroxide test, and controls were run on the pharmacist's mates who showed only slightly positive reactions. Meat-free diets were not given to either controls or patients because of the temporary nature of the illness, but accurate comparisons were easy to make on the basis of the rapidity of development and the intensity of the blue color on the filter paper and in the test tube.

exception of the signs of severe shock the physical examination was entirely negative. The blood pressure could not be obtained and the pulse was barely palpable.

Treatment consisted of absolute bed rest, morphia gr. ¼ with atropine gr. ¹⁄₁₅₀ every 4 hours as often as needed for rest and comfort, blood transfusions in amounts of 350 cc. of citrated blood given very slowly (about 1½ hours for each) given 24 hours apart. In 48 hours a modified Sippy diet, using amphojel instead of Sippy powders, was begun and the patient improved rapidly, in fact too rapidly for a peptic ulcer. On 12–30–41, small, sharp pieces of tin were found in the food and although the pieces were not observed in the stools, the evidence was overwhelmingly in favor of a traumatic injury in the intestinal tract, and the diagnosis was changed accordingly to hemorrhage, traumatic, intestinal tract. Treatment was then changed to a soft, bulky diet and recovery was rapid.

On 1–2–42 the patient's stools were negative for blood and he was sent to duty, symptomatically well.

CASE 4

Hemorrhage, traumatic, intestinal tract.—A seaman, first class, age 21, reported to the sick bay on 12–28–41, complaining of dizzy spells. He had never before experienced similar attacks and had no explanation for possible causes, such as lack of rest, overindulgence in alcoholic beverages, etc.

Examination was negative except for a blood pressure of 85/54 and a strongly positive occult blood test on his stool.

Treatment consisted of bed rest with a soft diet.

On 12–31–41 he was sent to duty apparently well.

COMMENT

Definite proof of the diagnosis made on these cases cannot be given, but the evidence is overwhelmingly in favor of a traumatic injury to the intestinal tract. The four cases presented almost identical symptoms and signs, including melena. The ship's cook's symptoms and signs were the most severe, but this might be explained by the fact that he was sampling the food as it was opened, thereby getting larger doses of metal. It may also be added that a continuous darkened ship was in effect at this time, making inspection of the food difficult, and meanwhile the opener was becoming more defective, causing larger pieces of metal to drop into the food. All of the cases developed within a short period of time. When the apparent cause was discovered, the entire crew was mustered and fed large quantities of thick oatmeal mush and strong tea as a prophylactic measure—the mush to gather up the pieces of metal in the gut, and the strong tea for the astringent action on the gut mucosa. This measure plus the replacement of the faulty can opener apparently effected the cure, since no new cases have developed and the original ones have remained perfectly well.

The can opener trouble was probably a combination of several factors: the tin cans are more brittle than formerly because of smaller amounts of tin used in their coating; the blade of this standard make

can opener was of poor quality, causing it to dull too rapidly; and inspection of equipment and food in the galley was difficult at the time these cases occurred. All factors have been corrected, except the quality of tin, and no further trouble has developed.

RECOMMENDATIONS

1. Unexplained cases of syncope or shock, or both, in spite of negative abdominal findings, should have stools examined for blood.

2. Increased vigilance in the inspection of food from the can should be practiced because of increased brittleness of tin.

A TEN-YEAR STUDY OF GONORRHEA IN THE UNITED STATES NAVY

By Lieutenant Commander F. R. Lang, Medical Corps, United States Navy

Part III [1]

ANALYSIS OF NEW ADMISSION RATES ACCORDING TO FIVE-YEAR AGE GROUPINGS

As the next consideration in this research it was decided to analyze the annual admission rates by 5-year age groups. This part of the study was confined strictly to a comparison of the rates of officers with those of enlisted men, and, therefore, midshipmen, aviation cadets, nurses and prisoners were excluded. Since there were no personnel of age 15, the first age group (16–19) is only a 4-year distribution. Table 13 sets forth the results of this analysis. In Graph 17 the rates are indicated visually for interpretation and comparison.

TABLE 13.—*10-year gonorrhea study, United States Navy*

[Comparison of rates per 1,000 of all officers with enlisted men of the Navy and Enlisted men of the Marine Corps]

Age groups	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	10-year rate
16–19 years:											
Officers											
Marines [1]	36. 70	48. 25	42 93	33. 94	17. 41	28. 66	22. 03	19. 39	15. 68	17. 70	26. 98
Navy [1]	97. 61	106. 50	114. 10	118. 05	120. 88	69. 59	85. 92	63. 89	55. 22	71. 27	87. 04
Total	85. 76	94. 85	103. 25	104. 01	78. 86	55. 47	66. 20	53. 87	45. 88	59. 38	73. 01
20–24 years:											
Officers	3. 24	2. 60	3. 36	7. 63	3. 20	3. 46	3. 26	5. 69	1. 65	. 72	3. 12
Marines [1]	94. 48	95. 25	105. 26	112. 32	100. 80	72. 67	74. 61	62. 36	59. 48	64. 11	85. 15
Navy [1]	118. 77	118. 40	133. 63	138. 85	120. 55	105. 58	94. 52	75. 76	77. 57	93. 70	106. 52
Total	111. 34	111. 51	124. 96	132. 22	114. 43	97. 55	88. 78	72. 13	72. 89	87. 07	100. 48
25–29 years:											
Officers	3. 43	2. 52	4. 31	2. 69	4. 76	2. 37	3. 42	2. 59	1. 76	1. 20	2. 83
Marines [1]	95. 37	96. 77	80. 65	111. 91	91. 50	75. 12	63. 30	60. 55	60. 13	59. 56	80. 96
Navy [1]	66. 17	65. 79	75. 15	79. 21	63. 08	59. 94	52. 58	42. 63	41. 02	47. 11	58. 53
Total	65. 27	64. 55	70. 30	78. 20	62. 85	58. 06	50. 58	41. 70	39. 64	43. 95	57. 04

[1] Enlisted.

TABLE 13.—*10-year gonorrhea study, United States Navy*—Continued

Age groups	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	10-year rate
30–34 years:											
Officers	3.11	1.51	......	.49	1.47	1.95	1.41	.92	.49	......	1.13
Marines [1]	67.28	41.55	38.36	55.45	50.03	38.72	39.19	26.38	36.86	20.41	40.24
Navy [1]	32.36	30.25	32.30	36.78	25.63	26.46	22.70	20.52	17.90	21.05	26.50
Total	30.78	27.63	29.09	34.44	25.28	24.89	21.83	18.70	17.67	18.59	24.79
35–39 years:											
Officers	......	1.65	.56	.53	......	.53	.52	......	.51	.97	.53
Marines [1]	33.40	19.58	19.34	27.50	28.65	12.35	15.96	22.10	15.81	7.22	1y.00
Navy [1]	14.13	18.67	16.63	17.87	14.46	12.45	11.35	9.87	8.05	10.90	12.69
Total	12.11	14.88	13.45	14.96	12.86	10.29	9.90	9.15	7.50	9.16	10.97
40–44 years:											
Officers	......	1.22	1.23	......	1.22	.63	.62	......			.48
Marines [1]	16.62	13.12	6.58	31.67	12.59	5.18	2.33	9.24	4.81	4.33	10.57
Navy [1]	11.40	7.11	10.26	10.66	7.80	15.95	5.15	6.47	9.97	8.69	9.26
Total	6.96	5.20	6.20	8.62	5.75	9.40	3.28	4.36	5.96	5.20	6.04
45–49 years:											
Officers					.75			*		4.33	.07
Marines [1]	13.89	5.38	9.62	14.22	13.51	9.95	5.03	4.15	......	4.33	7.77
Navy [1]	5.29	7.59	4.41	9.78	4.69	1.49	4.57	2.88	5.41	4.55	4.c3
Total	2.53	2.22	2.10	3.70	3.20	1.36	1.81	1.29	1.74	1.79	2.15
50–54 years:											
Officers											
Marines [1]	24.39						26.67				4.23
Navy [1]					8.13			6.45		6.21	2.30
Total	1.58				1.11		1.82	1.82		.83	.61
55–59 years:											
Officers											
Marines [1]					76.92						5.59
Navy [1]											
Total					3.44						.28
60–64 years:											
Officers											
Marines [1]											
Navy [1]											
Total											
65–69 years:											
Officers											
Marines [1]											
Navy [1]											
Total											
70–74 years:											
Officers											
Marines [1]											
Navy [1]											
Total											
Unknown:											
Officers											
Marines [1]											
Navy [1]											
Total											
Total all ages:											
Officers	1.58	1.46	1.34	1.10	1.69	1.21	1.27	1.03	.66	.48	1.15
Marines [1]	78.94	77.82	80.42	92.53	73.08	54.91	52.59	46.03	43.87	43.36	64.35
Navy [1]	82.93	82.61	89.07	90.97	73.71	63.95	58.32	49.31	49.57	60.96	69.24
Grand total	75.09	74.56	79.31	82.27	66.36	56.34	51.86	44.25	44.29	53.13	62.05

Note: These do not include midshipmen, nurses, or prisoners.

54 55 + OVER | TOTAL | 16-19 20-24 25-29 30-34 35 39 40-44 45-49 50-54 55 + OVER | TOTAL

——— 1933 ———

54 55 + OVER | TOTAL | 16-19 20-24 25-29 30-34 35-39 40-44 45-49 50-54 55 + OVER | TOTAL

——— 1938 ———
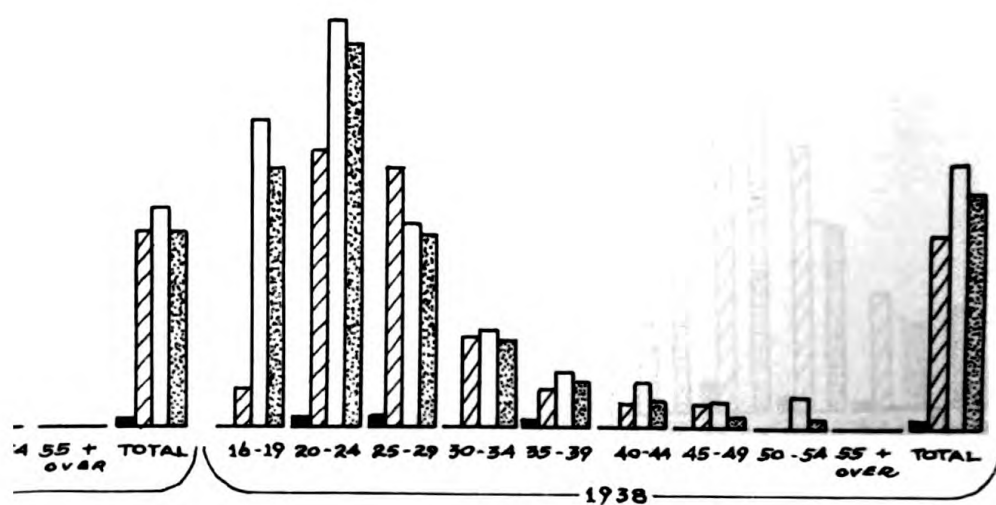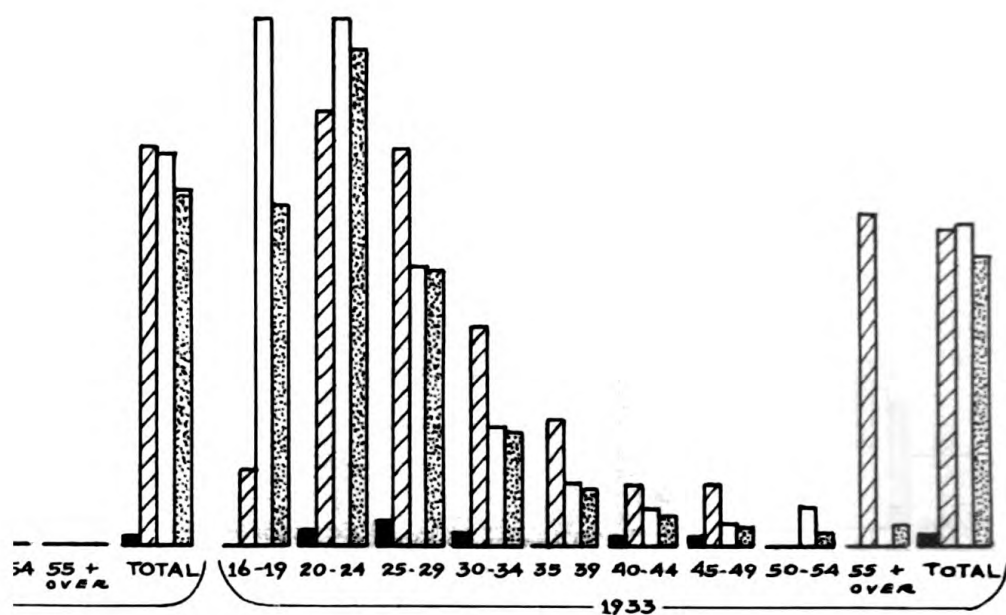
Graph 17 presents the following findings:

1. Of the total rates, those in the 5-year age grouping, 20–24, were consistently the highest during each year of the 10 years studied.

2. The findings in analyzing the annual admission rates among the two subdivisions of enlisted men were as follows: a. They were relatively high in the 16–19 group. b. They reached their highest point in the age group, 20-24. c. In the 25–29 grouping, they dropped off to a level lower than the 16–19 grouping. d. All 5-year age groupings dropped off very rapidly beyond the 25–29-year grouping.

3. In the 4-year age groupings, 16–19, and the 5-year grouping, 20–24, the Marine Corps enlisted men's rate consistently exceeded the Navy enlisted men's rate during each year of the study.

4. In all other 5-year-age groupings not included under three, the Navy enlisted men's rates consistently exceeded those of the Marine Corps.

5. The officers' admission rates were very low in all age groups and did not show any consistent wide fluctuations, nor was any particular age grouping persistently higher than any other. To illustrate: In 1929, the 30–34 age grouping was highest; in 1930, the 20–24 age grouping; in 1931, the 25–29 age grouping; in 1932, the 20–24 age grouping; and in 1933, the 25–29 age grouping was highest.

The facts brought out by a review of this part of the study are:

a. The vast majority of cases reported involved individuals of from 15 to 24 years of age.

b. The highest incidence of new cases of acute gonococcus infection of the urethra occurs in 20–24 age grouping.

A 1-YEAR STUDY OF NEW ADMISSION RATES ACCORDING TO ENLISTMENT PERIODS

As a matter of scientific interest it was decided to select 1 year of the study and analyze the annual admission rates of enlisted personnel of the Navy according to enlistment periods. The year 1938 was chosen, and table 14 and graph 18 present the results of this part of the research.

TABLE 14.—10-year gonorrhea study, United States Navy

CHI SQUARE DETERMINATIONS OF ENLISTMENT PERIODS FOR THE YEAR 1938 [1]

[Expected incidence derived from (a) Annual rate of enlisted men 1938 (.05826886656), (b) 10-year rate entire Navy (.06060807815)]

Enlistment period	Annual rate per 1,000	1938 (a) [1]					1938 (b) [1]				
		Average strength	Actual incidence	Expected Incidence	Chi square value	Degrees of significance	Average strength	Actual incidence	Expected incidence	Chi square value	Degrees significance
Less than 1 year			1,044					1,044			
1 year			1,703					1,703			
2 years			1,717					1,717			
3 years			1,062					1,062			
First enlistment period (4 years)	80.38	68,748	5,526	4,005.87	576.852	++	68,748	5,526	4,166.68	443.459	++
4 years			515					515			
5 years			170					170			
6 years			146					146			
7 years			125					125			
Second enlistment period (8 years)	49.30	19,390	956	1,129.83	26.745	—	19,390	956	1,175.19	40.882	—
8 years			161					161			
9 years			155					155			
10 years			122					122			
11 years			115					115			
Third enlistment period (12 years)	39.42	14,029	553	817.45	85.551	—	14,029	553	850.27	103.931	—
12 years			47					47			
13 years			32					32			
14 years			48					48			
15 years			38					38			
Fourth enlistment period (16 years)	13.50	12,222	165	712.16	420.389	—	12,222	165	740.75	447.503	—
16 years			18					18			
17 years			15					15			
18 years			20					20			
19 years			3					3			
Fifth enlistment period (20 years)	7.02	7,962	56	463.94	358.699	—	7,962	56	482.56	377.059	—
20 years			3					3			
21 years											
22 years			1					1			
23 years											
Sixth enlistment period (24 years)	1.88	2,127	4	123.94	116.069	—	2,127	4	128.91	121.034	—
24 years			1					1			
25 years											
26 years											
27 years											
Seventh enlistment period (28 years)	1.16	86	1	5.01	3.210	0	86	1	5.21	3.402	0
28 years and over											
Eighth enlistment period (and over)		48		2.80		0	48		2.91		0
Total		124,612	7,261	7,261.00		0	124,612	7,261	7,552.49	11.250	0

The annual age of recruits on enrollment in their first enlistment during this study period was as follows:

GRAPH 18.
TEN-YEAR GONORRHEA STUDY–U.S. NAVY
COMPARISON of RATES PER 1,000 by ENLISTMENT PERIODS FOR 1938
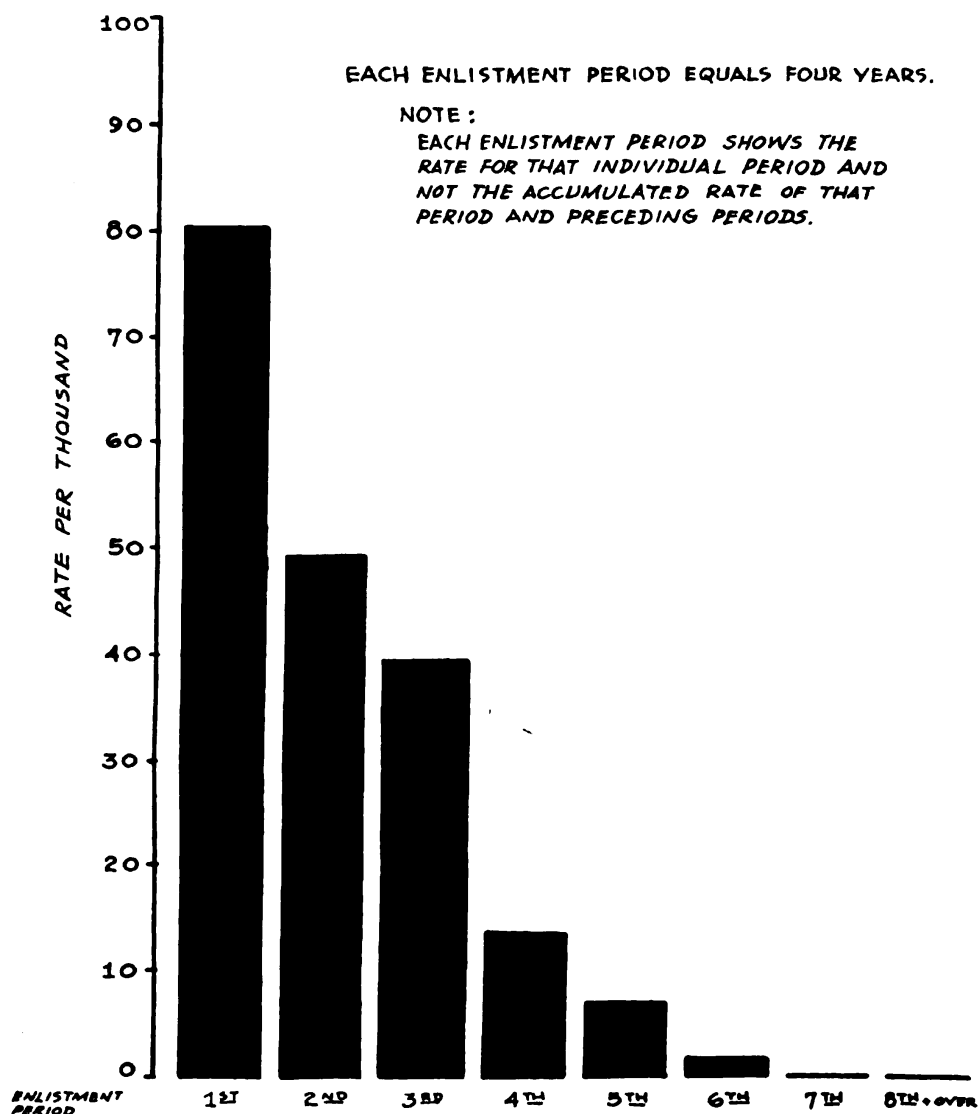
EACH ENLISTMENT PERIOD EQUALS FOUR YEARS.

NOTE :
EACH ENLISTMENT PERIOD SHOWS THE RATE FOR THAT INDIVIDUAL PERIOD AND NOT THE ACCUMULATED RATE OF THAT PERIOD AND PRECEDING PERIODS.

Year:	Average age at beginning of first enlistment	Year:	Average age at beginning of first enlistment
1929	19.06	1935	20.15
1930	19.06	1936	20.11
1931	19.03	1937	19.76
1932	19.62	1938	19.82
1933	19.83	10-year average age	19.59
1934	19.48		

In view of this disclosure, the average admission rate of the first enlistment period would be expected to correspond roughly to the age grouping 20–24, and inasmuch as this age grouping showed the highest incidence of new admissions, it is to be expected that the highest admission rate per 1,000 would occur in the first enlistment period. Graph 18 and table 14 confirm this expectation. From graph 18 it is learned:

1. That the admission rates per 1,000 decreased 40 percent during the second enlistment period.

2. The rates per 1,000 during the third enlistment period were 50 percent less than were those of the first enlistment.

3. After the third enlistment period there was a marked drop in rates to a level approximating one-third of the rates for the first enlistment period.

A 2-YEAR COMBINED ANALYSIS OF NEW ADMISSION RATES BY 1-YEAR LENGTH OF SERVICE PERIODS.

TABLE 15.—*10-year gonorrhea study, United States Navy*

LENGTH OF SERVICE, ENLISTED MEN IN THE NAVY, 1935 AND 1936 COMBINED, SHOWING AVERAGE STRENGTH, ACTUAL INCIDENCE, EXPECTED INCIDENCE, RATES PER 1,000, AND CHI SQUARE VALUES

[Expected incidence derived by applying rate of the entire Navy for the 2 years—1935 and 1936]

Length of service	Average strength	Actual incidence	Rate per 1,000	Expected incidence	Chi square value	Degrees of significance
Less than 1 year	28,237	1,647	58.33	1,530.74	8.830	+
1 year	21,707	2,054	94.62	1,176.75	653.977	++
2 years	14,293	1,353	94.66	774.83	431.424	++
3 years	10,000	907	90.70	542.10	245.623	++
4–7 years	36,686	2,300	62.69	1,968.76	48.709	++
8–11 years	27,871	852	30.57	1,510.90	287.345	−
12–15 years	22,963	370	16.10	1,245.92	615.799	−
16–19 years	13,545	75	5.54	734.28	591.941	−
20 years and over	991	000				
Total	176–313	9–558	54.21	9–558.00	000.000	

As a further investigation in this part of the study, it was considered of value to analyze the new case admission rates of the Navy enlisted men according to length of service in years. The combined average strengths and incidences of 1935 and 1936 were chosen for this purpose. By definition, an individual with more than 1 year of service and less than 2 was counted in the 1-year group; those with over 2

GRAPH 19.
TEN-YEAR GONORRHEA STUDY—U.S. NAVY
RATES PER 1,000 BASED ON ONE YEAR LENGTH OF SERVICE PERIODS FOR NAVY ENLISTED MEN ONLY
1935 - 1936 COMBINED
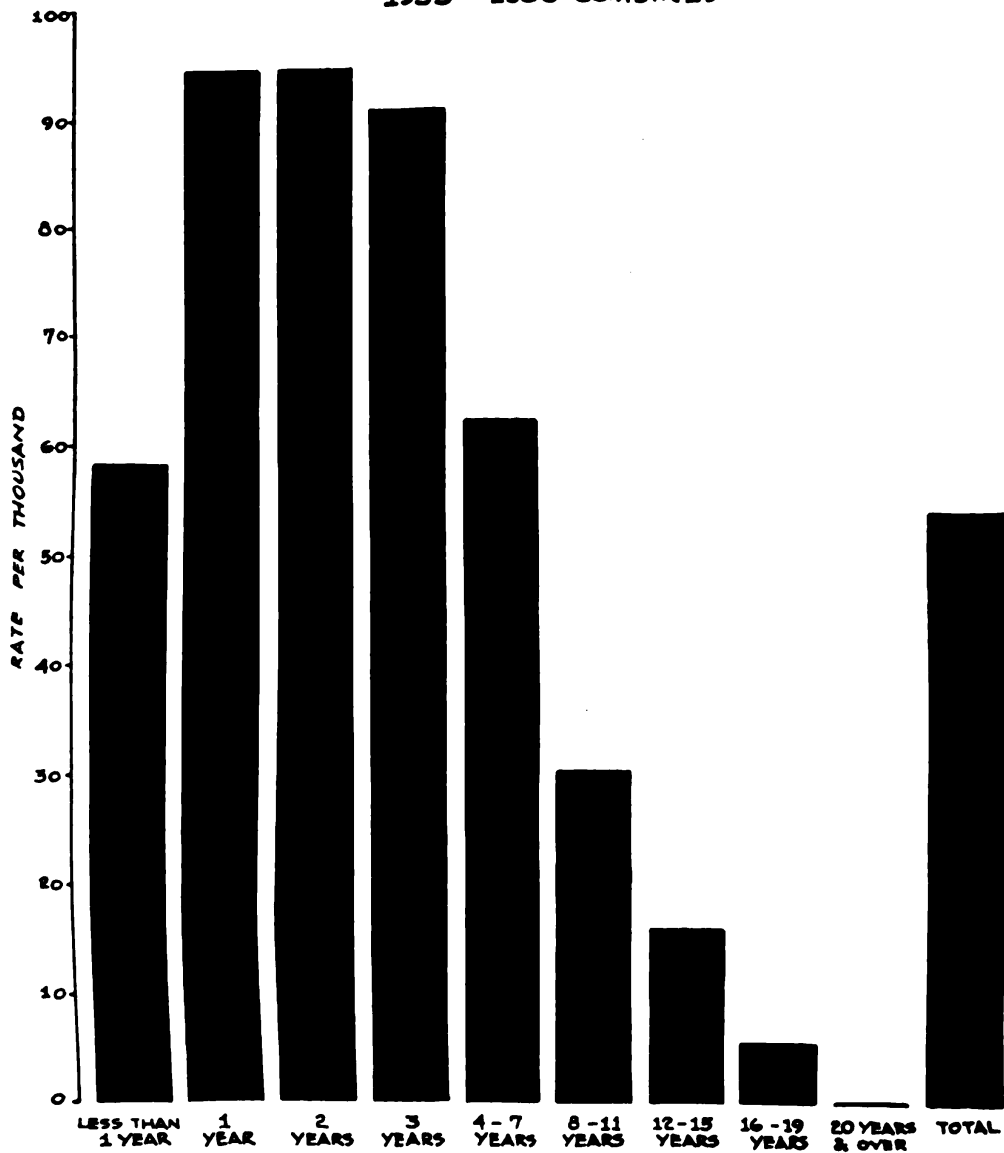
years of service and less than 3 were counted in the 2-year group, and so on. Table 15 and graph 19 present the findings of this part of the research. During the first enlistment period of the 2 years combined, the highest rates were attained during the first and second years of service—both of these years had combined rates which were extremely high, and practically identical. The rate of the third year of service was slightly lower. Beyond 3 years the admission rate drops off sharply. The rates of Navy enlisted personnel with less than 1 year of service were 39.2 percent lower than were the 1- and 2-year length of service rates of experience.

ANALYSIS OF NEW ADMISSION RATES OF THE VARIOUS RACES ENROLLED IN THE UNITED STATES NAVY

As a final break-down in this research problem an analysis of new case admission rates in the Navy was undertaken according to races.

Table 16 indicates the rates per 1,000 and the percentage of total average strength of the five races found among naval personnel.

Graph 20 presents the percentages of the Navy population by races during the period of study. It shows the extremely small proportion of total naval personnel made up of members of the red and yellow races.

TABLE 16.—*10-year gonorrhea study, United States Navy*

[Rates per 1,000 for "races" and percentage of total average strength 1929-1938]

Race	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	10-year rate
(a) White	75.03	74.27	78.52	81.95	66.44	55.72	50.57	42.03	42.56	50.60	61.01
(b) (Negro) Black	32.19	19.44	15.45	12.68	34.60	95.70	128.89	145.54	124.78	162.62	113.56
(c) Yellow	45.80	61.40	33.06	79.14	37.59	50.42	16.81	24.79	8.33	23.26	38.52
(d) (Insular) Brown	31.04	36.63	36.62	44.24	32.72	32.73	25.98	26.83	20.41	21.06	32.36
(e) (Indian) Red	117.65	47.62	160.00	107.14	32.26			38.46		157.89	60.73

PERCENTAGE OF TOTAL AVERAGE STRENGTH

Race	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	
(a) White	95.44	95.47	95.40	95.46	95.47	95.58	95.72	96.06	96.29	96.26	95.74
(b) (Negro) Black	.42	.39	.40	.43	.56	.85	1.35	1.62	1.69	1.96	1.00
(c) Yellow	.11	.10	.11	.13	.12	.11	.10	.10	.09	.09	.11
(d) (Insular) Brown	4.01	4.02	4.07	3.96	3.81	3.44	2.80	2.20	1.92	1.77	3.14
(e) (Indian) Red	.01	.02	.02	.03	.03	.03	.02	.02	.02	.01	.02

The annual average strength of members of the red race during the study period was extremely small and varied annually between 17 and 31. There was a 10-year total of only 247 man-years of experience, and, therefore, an annual average of only 24.7 men. Since a chance variation of only 1 new case per year would cause a considerable shift in rate, it is readily seen that the annual rates of this small population cannot be used accurately for purposes of comparison with the larger race group rates.

GRAPH 20.

TEN-YEAR GONORRHEA STUDY – U.S.NAVY
PERCENTAGE of AVERAGE STRENGTH
OVER TEN YEAR PERIOD by RACES

95.74 %

0.11 %

3.14 %

1.00 %

0.02 %
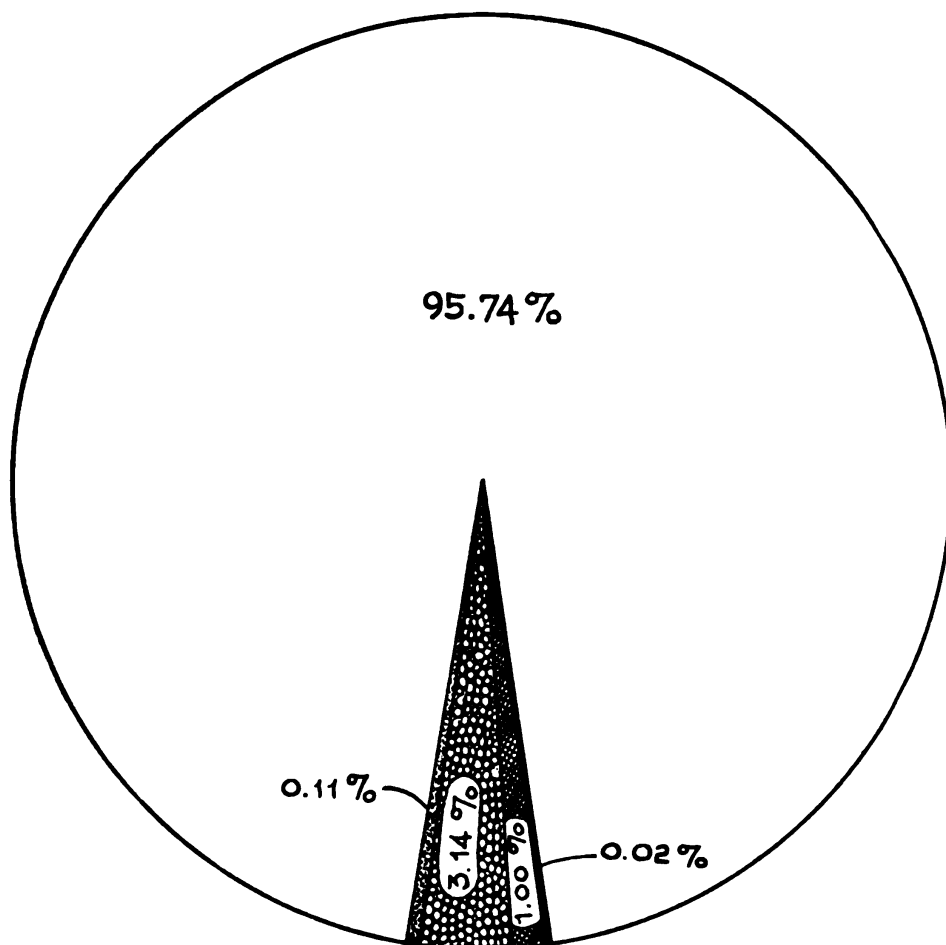
▨ YELLOW   ☐ WHITE   ▨ BROWN

■ BLACK   ■ RED

. The yellow race experience in the study period shows annual "average strengths" which ranged between 114 and 129 with a total of 1,246 man-years of experience. The average annual population of this race for the 10-year period would, therefore, be 124.6. While the chance variation of 1 new case annually among the members of this race would not result in such a marked change in rate as for the red race, yet the rates obtained must be interpreted cautiously, since the divergence in total person-years is so considerable among the different races. The total person-years for the different races are shown as follows:

Race:	Total person-years in 10-year study period
(a) White	1,136,004
(b) Brown	37,236
(c) Black	11,826
(d) Yellow	1,246
(e) Red	247

GRAPH 21.

TEN-YEAR GONORRHEA STUDY— U.S.NAVY

NEW ADMISSIONS, RATES PER 1,000 of the FIVE RACES

PERCENTAGE of TOTAL AVERAGE STRENGTHS by RACES
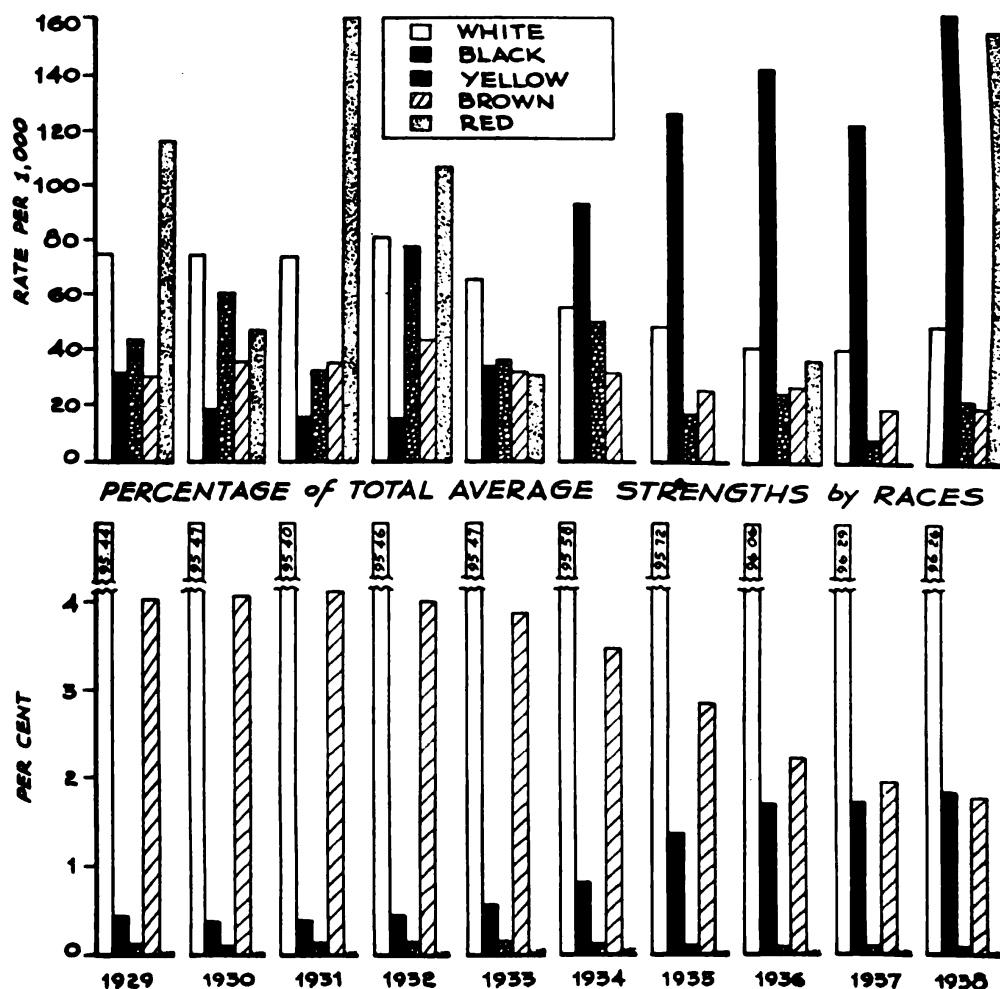
In graph 21 the rates as obtained are charted. It is seen at once that annual admission rates for the red race must be disregarded for the reasons already stated. Ignoring the red race rates, graph 21 demonstrates that:

1. The white race annual admission rates were the highest in the first 5 years of the period studied.

2. The rates of the black race were highest in the second 5 years when they rose suddenly, beginning in 1934, and thereafter climbed steadily. As stated previously, the annual average strength of this race increased rapidly after 1934. It varied between 473 in 1932 and 2,695 in 1938.

3. The admission rates for the white and yellow races show the same over-all trends as those revealed in most subdivisions of this study: namely, a steady decline of rates from 1932 to 1936 and then a slight increase in 1937 and 1938.

SUMMARY

1. *Study.*—An epidemiological analysis of 10 years of experience with acute gonorrheal infections in the United States Navy.

2. *Object of study.*—To determine how (*a*) type of duty, (*b*) location of duty, (*c*) size of medical activity, (*d*) occupation, (*e*) length of service, (*f*) age, and (*g*) race, influence the epidemiology of gonorrhea in the naval service.

3. *Study group.*—The entire personnel of the United States Navy (including personnel of the United States Marine Corps).

4. *Study period.*—The calendar years 1929 to 1938, inclusive. This represents 1,186,558 naval person-years of experience.

5. *Definition.*—Study confined to "new cases," i. e., admissions of acute gonococcal infections of the urethra. Cases which existed prior to enlistment, or which were relapses or recurrences of a previous gonorrheal infection are not included.

6. *Basic variables of the study.*

I. Controllable variables: (*a*) Rates of incidence, (*b*) length of service, (*c*) age, (*d*) occupations, (*e*) race.

II. Uncontrollable or indeterminate variables: (*a*) Certain number of relapsing or recurring infections may have been reported as new cases. (*b*) A certain number of new cases may have been reported as readmissions (relapses and recurrences), and therefore were lost to the study.

7. *Findings.*

(*a*) The incidence of gonorrhea in the Forces Afloat during this study period was over 100 percent higher than that in the Forces Ashore.

(*b*) Among the various fleets, forces, squadrons, services and detachments of the forces afloat, the Asiatic Fleet, the special service squadron, the European squadron and the naval transportation service had rates which were consistently and significantly higher than the remaining classifications of the Forces Afloat.

(*c*) An analysis by **functions of ships** indicates that the auxiliary ships constantly en route had admission rates which were considerably and very significantly higher than those of the fighting ships or of the auxiliary ships stationed constantly in home ports.

Auxiliary ships stationed in home ports had rates which were significantly lower than those of the fighting ships during 4 years of the study.

(*d*) Among the **fighting ships** the **fleet submarines** had an extremely and consistently low annual admission rate, ranging from one-half to one-sixth of that of all fighting ships combined. The remaining ships in this category had admission rates which were not significantly different from one another, nor from the general rate of all fighting ships.

(*e*) **The auxiliary ships constantly en route** all had annual rates which were very high. Among this group the transports, store ships, and ammunition ships had the highest admission rates.

(*f*) Among the **auxiliary ships stationed constantly in a home port**, no single class of ships stands out as having annual admission rates which differed significantly from the remainder.

(*g*) **Gunboats** which were stationed on Chinese rivers during this study period had the highest rates of all classes of ships.

(*h*) **The Forces Ashore outside the continental limits of the United States** had annual admission rates considerably, consistently, and significantly higher (varying between 10 and 100 percent) than were those of the forces ashore within the continental limits.

(*i*) **Naval personnel ashore in naval districts situated within the continental United States** had rates which were low. Only the "Activities of the Potomac and Severn Rivers" showed rates which varied from the remainder of the forces ashore in the continental United States. These were consistently low but not greatly significant in differences from the remainder.

(*j*) **Of the naval districts outside the continental United States** the fourteenth naval district (Hawaiian Islands) and the fifteenth naval district (Panama Canal Zone) had rates which did not differ significantly from those of the naval districts situated in the continental United States. Only the rates of the sixteenth naval district (Philippine Islands) were significantly and consistently higher.

(*k*) **Forces Ashore stationed with naval activities not included in naval districts** (Island possessions and expeditionary forces) on the whole had high rates, the highest being found among the forces ashore in China. It is a curious finding that the forces ashore in Guam had extremely low rates (the lowest of any subdivision of the study) while those stationed in Samoa (under similar conditions of geographical isolation and with comparable size and types of na-

tive population) had rates which were significantly high. Rates of remaining activities varied widely but were not significantly different from each other.

(*l*) **Forces stationed ashore in civilian communities within the continental United States** had rates which showed considerable annual variation. Only New Orleans, La.; San Francisco, Calif.; Norfolk, Va.; Philadelphia, Pa.; and Boston, Mass., had 10-year rates above the average of all communities. However, their annual rates fluctuated and were not persistently higher during the entire study period than were those of the remaining 15 communities studied.

(*m*) **Forces stationed ashore in civilian communities outside the continental United States** had rates which fluctuated considerably, but these were higher than were those of personnel on duty in civilian communities within the continental United States. They were also higher than the remainder of the Forces Ashore. Forces ashore in communities in China had persistently and significantly the highest rates. The rates of the Honolulu area remained consistently and significantly lowest in this category.

(*n*) **Naval hospitals.**—Personnel on duty in naval hospitals located outside the continental United States had rates which varied between 100 percent and 300 percent higher than were those of personnel on duty in naval hospitals located within the United States. Only the naval hospital at Pensacola, Fla., had annual rates which were significantly higher than the remainder. The naval hospitals at Canacao (Manila area) and Guam had markedly high rates. The hospital at Pearl Harbor (Honolulu area) had significantly low rates.

(*o*) **Occupations.**—Nurses showed no incidence in 4,356 person-years. Officer personnel and those in similar occupations had extremely low rates. Marine officers and Marine aviation cadets had the lowest rates in this break-down. Seamen and fireroom personnel showed rates not significantly different from each other, and these were the highest of any of the occupations. The lowest admission rates were found in the Hospital Corps, aviation personnel, and among apprentices. The rate for the culinary group increased rapidly from 1933 to 1938 and paralleled exactly the rapid increase in the average strength of the Negro race which occurred in this same interval. Other occupational groupings did not vary significantly from each other.

(*p*) **Five-year age groupings.**—The 5-year age group, 20–24, inclusive, showed up repeatedly and consistently with the highest admission rates. The admission rates of the Marine Corps enlisted men were the highest in the 16 to 19 and 20 to 24 age groups. Rates of the Navy enlisted men were the highest in all of the remainder of the 5-year age groupings. Officers showed no single age group-

ing with an outstanding and persistent rate. Annual admission rates of officers and enlisted men all dropped off precipitously after the 25- to 29-year age grouping.

(*q*) **Enlistment periods.**—The highest admission rates occurred in the first enlistment period during the year chosen (1938). During the second enlistment periods, rates were 40 percent lower. Enlistment period admission rates reduced rapidly after the third period.

(*r*) **One year length of service periods.**—The highest annual rates were discovered to exist during first, second, and third years in the Navy. After the third year the rates dropped off very rapidly.

(*s*) **Race.**—Rates obtained for the red race must be disregarded because of the small numbers involved in the average strength of this race. Yellow race rates are of questionable value for the same reason. White race rates were the highest during the first 5 years of study. Those of the black race were highest during the second 5 years. The rapid increase in the black race admission rates between 1934 and 1938, inclusive, bears a definite correlation with the rapid increase in members of this race in the total Navy population during those years.

(*t*) The decline in rates between 1932 and 1936 coincided accurately in time interval with the increased enforcement of drastic punitive measures; thereby suggesting the possibility of this decline in rate being attributed to increased attempts at concealment. Conversely the removal of the more drastic punitive measures during 1936 shows a positive correlation with the increase in rates in 1937 and 1938.

CONCLUSIONS

1. Among the primary subdivisions of the study the highest gonorrheal new admission rates are found in:
a. Forces Afloat.
b. Forces Ashore stationed in foreign territory.

2. Measures for the control of gonorrhea should be concentrated and pushed more strenuously among:
a. The following forces afloat: Asiatic Fleet, naval transportation service, forces in the Caribbean and European areas.
b. Among forces stationed ashore in foreign countries.

3. The amount and degree of instruction in sex hygiene and venereal disease control apparently is not a factor which influences the new case admission rates of gonorrhea.

4. Type of ship (size of Medical Department) appears to have no influence on gonorrheal new admission rates; whereas, location and activity of ship bears a direct correlation.

5. The admission rate for new cases of gonorrhea varies in inverse proportion as the local economic and social standards resemble those found in the continental United States.

6. New admission rates for gonorrhea in the United States Navy vary inversely as does the level of intelligence and education required for the various occupational groups. (Exception: Apprentice seamen. The greater percentage of these men had less than 1 year of service and 6 months of this was spent in a training station.)

7. The results of this study indicate that venereal disease control program in the United States Navy should be concentrated on the younger men with less than 4 years of service.

8. Among the facts brought out it appears that as part of the venereal disease control program of the United States Navy there should be a selective assignment of men to foreign duty. As few men as practicable who are immature in age and who have had less than 4 years of experience in readjustment to Navy life should be sent to foreign duty.

The End

STATISTICS

The statistics (annual rates per 1,000) appearing in this summary were compiled from data contained in monthly reports of communicable diseases received in the Bureau for the months of October, November, and December, 1941.

ENTIRE NAVY

Year	All diseases	Injuries and poisonings	All causes	Communicable diseases		Venereal diseases
				A	B	
1936	474	76	550	15	118	96
1937	472	39	511	11	118	93
1938	325	57	382	4	76	81
1939	363	54	417	3	84	98
1940	511	49	560	35	223	81
1941	332	59	391	13	100	45

FORCES ASHORE

1936	459	98	557	13	121	46
1937	535	49	583	11	169	55
1938	330	55	386	7	104	40
1939	368	54	422	4	117	52
1940	487	49	536	27	229	52
1941	366	58	424	18	126	30

FORCES AFLOAT

1936	525	63	546	15	115	125
1937	398	34	469	10	89	116
1938	321	59	380	2	59	103
1939	360	54	414	3	64	126
1940	533	48	581	43	219	106
1941	294	60	354	7	72	62

Common infectious diseases of the respiratory type.—During the quarter ending December 31, 1941, there were 9,712 admissions for these diseases reported for the entire Navy—6,168 from shore stations in the United States, 3,320 from Forces Afloat, 197 from Fleet Marine Force, and 27 from foreign shore stations. Catarrhal fever was responsible for 6,990 of the admissions.

Ships and shore stations reporting the greatest number of admissions were as follows:

Ship or station	October	November	December	Total
Naval Training Station, Great Lakes, Ill_____	189	177	222	588
Naval Air Station, Jacksonville, Fla_____	147	125	82	354
Naval Air Station, Alameda, Calif_____	38	100	171	309
Naval Training Station, San Diego, Calif_____	96	120	75	291
Marine Corps Base, San Diego, Calif_____	33	64	146	243
Naval Training Station, Newport, R. I_____	74	58	110	242
Naval Training School (Navy Pier) Chicago, Ill__	14	61	161	236
Naval Air Station, Norfolk, Va_____	63	73	97	233
Naval Air Station, Corpus Christi, Tex_____	95	54	47	196
Naval Training School (Signals), Chicago, Ill_	27	79	75	181
Marine Barracks, Parris Island, S. C_____	44	30	96	170
Naval Service School, Dearborn, Mich_____	54	37	71	162
Naval Air Station, Pensacola, Fla_____	78	38	43	159
First Marine Division, F. M. F_____	55	27	57	139
Naval Training Station, Norfolk, Va_____	54	48	30	132
U. S. S. *Arkansas*_____	75	14	17	106
Naval Air Station, Seattle, Wash_____	32	31	40	103
Sixth Marines (Reinforced) F. M. F_____	29	26	47	102
Second Marine Division, F. M. F_____	_____	41	60	101
Battle Force, Fleet Air Detachment_____	29	26	43	98
Naval Air Station, Miami, Fla_____	31	33	32	96
Naval Air Station, San Diego, Calif_____	24	26	39	89
Marine Barracks, Quantico, Va_____	22	36	15	73
Naval Training School, Toledo, Ohio_____	12	32	29	73
Naval Air Station, Pearl Harbor, T. H_____	22	26	19	67
Dispensary, Navy Department, Washington, D. C____	25	16	26	67
U. S. S. *Colorado*_____	9	14	41	64
U. S. S. *Washington*_____	9	20	34	63
U. S. S. *Ranger*_____	11	23	28	62
U. S. S. *North Carolina*_____	21	15	25	61

Tonsillitis, acute—U. S. S. "California"—(Special report dated November 19, 1941.)—A mild epidemic of acute lacunar (follicular) tonsillitis occurred aboard this vessel between November 4 and November 8, 1941, during which time 292 men were admitted to the sick list. Admissions were recorded as follows:

November 4_____ 72
November 5_____ 142
November 6_____ 64
November 7_____ 10
November 8_____ 4
                                                                ———
                                                                292

Symptoms.—Chilliness, headache, anorexia, general bodily pains, and a considerable degree of prostration were noted. Onset of symptoms was abrupt. The pharyngeal mucous membrane and tonsils showed an intense inflammatory engorgement covered with a layer of muco-purulent secretion. Tonsillar crypts were filled with exudate, and submaxillary lymph nodes were moderately swollen

and tender. Temperature ran as high as 104° F. with an average of 101° F. The temperature dropped quickly in the majority of the cases, often 1 or 2 degrees a few hours after admission. Average number of sick days, 5.

Laboratory findings.—Blood count showed a leukocytosis averaging 12,000; throat smears showed short chains of streptococci. Cultures made aboard the U. S. S. *Solace* revealed non-hemolytic streptococci.

Complications.—Four cases developed peritonsillar abscesses. No other complications. These readily healed after surgical drainage.

Epidemological.—This type of sore throat was endemic in the Long Beach area during our stay there from October 16 to November 1, 1941. The weather was very changeable with a few rainy days after a period of drought. Toward the end of our stay there was considerable fog at night, causing the men to become chilled while waiting on the dock for the ship's boats. They, no doubt, harbored the organisms and spread the infection due to the crowded berthing conditions.

Milk was considered as a possible source of infection as fresh milk was served daily. However, this was pasteurized milk from a reliable Navy contractor.

Prophylaxis.—The following measures were put in effect:

Isolation of patients. One section of the ship on the main deck, forward, was set aside for these patients.

Instructions were issued for all men with colds or sore throats to report to the sick bay.

Daily inspection of food handlers.

Search for common drinking cups.

Greater care in sterilization of mess gear. (This was not considered a source of infection as the sterilizing machinery is new and is maintained at the proper temperatures).

Treatment.—Symptomatic, except in about 50 cases where salfanilamide or sulfathiazole was given.

Other infectious diseases.—There were 175 admissions for measles, 249 admissions for german measles, and 258 admissions for mumps. Ships and shore stations reporting the greatest number of admissions were as follows:

Ship or station	German measles	Measles	Mumps
U. S. S. *Astoria*	0	0	35
U. S. S. *Northampton*	0	0	29
Naval Training Station, Newport, R. I.	9	0	1
Marine Corps Base, San Diego, Calif	21	11	0
Naval Air Station, San Diego, Calif	14	1	0
Hospital Corps School, San Diego, Calif	9	5	0
Naval Training Station, San Diego, Calif	56	83	9
Naval Air Station, Alameda, Calif	35	6	62
Naval Radio Station, Bainbridge Island, Wash	5	4	2
Naval Air Station, Seattle, Wash	11	0	8

Chickenpox.—Thirty cases of chickenpox were reported for the quarter, nine of which were admitted to the sick list on board the U. S. S. *Henderson.* Two cases each were reported from the Norfolk

Navy Yard, Portsmouth, Va.; Naval mine depot, Yorktown, Va.; naval training station, San Diego, Calif.; and receiving station, San Diego, Calif. Single cases were reported from five ships and eight shore stations.

Scarlet fever.—Nine of the twenty-seven cases of this disease reported for the quarter occurred at the naval training school, Toledo, Ohio. Three cases each were reported from the naval training station, Norfolk, Va.; and the naval training school (Signals), Chicago, Ill.; and two cases each from the naval service school, Dearborn, Mich.; and the naval air station, Alameda, Calif. Single cases were reported from eight shore stations. No cases of scarlet fever were noted in reports received from forces afloat.

Poliomyletic, anter, acute.—Single cases of this disease were reported by the Fleet air detachment, Battle Force; Naval Reserve aviation base, Atlanta, Ga.; naval hospital, Great Lakes, Ill.; U. S. S. *Cummings;* and U. S. S. *Hilary P. Jones.*

Diphtheria.—Four cases of diphtheria were reported during the quarter, three from the naval training station, Great Lakes, Ill., and one from the section base, Sabine Pass, Tex.

FOOD POISONING

U. S. S. *Pensacola.*—(Special Report dated December 20, 1941.)—An outbreak of food poisoning occurred aboard this ship on December 4, 1941, the first case appearing at 8 a. m. and the last case at 6 p. m. The epidemic reached its peak at 11 a. m. and dwindled to an occasional case by 3 p. m. All rates and every division of the general mess were affected. The onset was moderately explosive in nature but fairly easily controlled.

Sixty-six cases were seen and treated. Fifty-one appeared at the sick bay voluntarily and 15 appeared after a search was made for cases of mild abdominal discomfort. Two of the sixty-six cases required admission to the sick list, exhibiting typical signs and symptoms of an acute fulminating food poisoning with sudden onset, vomiting and retching, marked and bloody diarrhea, extreme cramplike abdominal pains, prostration, subnormal temperature, and a gasping type of respiration. Urine remained normal but there was a leukocytosis of twelve to eighteen thousand with a moderate shift to the left.

Treatment consisted of repeated gastric lavage with warm salt water, followed in 3 hours by bismuth compounds. Complete and rapid cures resulted, many of the patients returning to their own bunks from 4 to 12 hours after onset of symptoms. All patients were seen frequently throughout the day and checked again the next

morning, at which time no complaints were registered except a feeling of mild weakness. The two patients officially admitted to the sick list recovered rapidly and returned to duty well in the morning of December 6, 1941.

Breakfast consisted of chipped beef, fried potatoes, coffee, bread, butter, and whole apples. Investigation revealed that the chipped beef, contrary to existing instructions, had been removed from the cans and soaked in fresh water over night. It was then warmed and creamed for breakfast. Many of the crew "nibbled" at the chipped beef and suffered no ill effects, but all who indulged to any extent became ill. The small number of actual cases of food poisoning can be explained by a general dislike of the food involved, and, of course, by the possible partial contamination of the beef. All cans were apparently in good shape before opening and investigation of other cans of the same product revealed no condemning features. No bacteriological or cultural facilities were available and it was impossible to forward specimens to a laboratory for confirmation of the suspected food. However, no doubt can exist as to the source of this outbreak. Instructions have been issued that chipped beef in the can is to be opened, soaked, and cooked on the morning it is to be served.

Conclusions.

1. Chipped beef should not be soaked the night before serving.

2. It should be thoroughly cooked and not just warmed prior to serving.

U. S. S. "Ranger".—(Special report dated October 23, 1941).—On October 20, 1941, 39 men reported to the sick bay aboard the U. S. S. *Ranger* between the hours of 12:30 p. m. and 2:30 p. m. with the symptoms and findings of food poisoning.

Symptoms consisted of moderately severe abdominal cramps, nausea and vomiting, and diarrhea. Indicated laboratory studies in cases chosen at random were within normal limits and the positive physical findings were limited to moderate generalized abdominal tenderness.

Epidemiological study of this outbreak indicated that all affected men received their food from the general mess. All had eaten the morning meal, all but 12 had eaten the noon meal, and all but 22 had eaten the evening meal on October 19, 1941. Seventeen men had not been ashore during the previous 48 hours.

The morning meal on October 20, 1941, consisted of creamed eggs on toast, fried potatoes, fruit cake, butter, coffee, and oranges. Of these items all men showing symptoms consumed the creamed eggs whereas each of the other foods were omitted by from 4 to 6 of the men.

The creamed eggs were prepared by boiling and shelling the eggs approximately 12 hours prior to serving; they were placed in covered stainless steel containers in the refrigerator at 48° F. about 2 hours after boiling, and were removed about 1½ hours before serving. The sauce consisted of klim, butter, and water, which was boiled, poured over the eggs, and served.

All of the creamed eggs were consumed at the morning meal and no specimens could be obtained for bacteriological examination.

Examination of all food handlers involved in the preparation of this meal failed to reveal any source of infection.

All but two of the patients became asymptomatic within 12 hours. These patients were retained in the sick bay for 48 hours because of abdominal cramps and weakness.

Due to the low morbidity rate and the moderation of the disease it is believed that this outbreak may be attributed to a contamination of a small portion of the creamed eggs served for breakfast on October 20, 1941, and that this contamination was most probably introduced by a single food handler's failure to abide by existing sanitary instructions.

U. S. S. "Cincinnati".—(Special report dated October 30, 1941).— An outbreak of food poisoning occurred on board the U. S. S. *Cincinnati* on October 24, 1941, involving about 125 men. Minced ham and egg sandwiches were served to the entire crew at 9:30 a. m. and the first man became ill about noon.

The symptoms of food poisoning came on very suddenly. Within a period of 2 hours 92 men reported to the sick bay with the symptoms of nausea, vomiting, and severe and intermittent cramps. A considerable number who were ill did not report to the sick bay for treatment. All of the patients appeared acutely ill and varying degrees of shock were noted. They were pale, covered with profuse perspiration, and showed general signs of prostration. Temperature was normal to subnormal. There was excessive salivation and a bitter taste in the mouth. The pulse was increased but the blood pressure was not taken. Following the acute stage a severe watery diarrhea developed, marked dehydration was evident, and some patients complained of blurred vision and muscular leg cramps. All patients made an uneventful recovery within 12 to 24 hours.

Careful questioning of the men during the outbreak and afterwards brought out the fact that none of them had felt ill during the morning. Some had not eaten breakfast due to the early hour of arising and were very hungry when the sandwiches were served at 9:30 a. m. All of the patients who were ill had eaten one or more of the minced ham and egg sandwiches and became ill about the same time and with the same symptoms.

Messing aboard this ship has been very satisfactory. The men are fed cafeteria style and the food has been of good quality, carefully prepared, and properly served. Daily inspections of the food, galley, serving tables, cooks, and mess cooks are held. Careful examination of the menu during the preceding 48 hours showed no possible source of food infection.

Investigation showed the suspected sandwiches were made in the following manner: The ham and eggs were broken out of the ice box about 4 p. m. on October 23, 1941, and were taken to the galley. The ham was boiled in the coppers from 6 p. m. to 10 p. m., and then removed from the coppers into a dishpan. At 1 a. m., October 24, the eggs were boiled and the hams were boned; at 2 a. m. the ham was ground and left in a dishpan in the galley, and at 3 a. m. part of the eggs were peeled, mixed with some of the ham, and 60 sandwiches were made to go with the target repair party. These sandwiches were eaten about 7:30 a. m. and none of the men suffered any ill effects. Between 8 a. m. and 9:30 a. m. the remaining eggs were peeled, mixed with the ham, and about 650 sandwiches were made and served to the crew. Salt and pepper only was added to the mixture while making the sandwiches. It is believed that the outbreak of food poisoning was caused by ham which became contaminated during preparation and after being left in a warm galley for a period of over 6 hours. None of the suspected sandwiches were available for examination.

Naval training school, Navy pier, Chicago, Ill.—(Special report dated November 5, 1941).—An epidemic of food poisoning occurred at this activity on November 2, 1941. The suspected food was creamed chicken, prepared in the following manner: ·

(*a*) Chickens in frozen condition were taken directly from butcher at noon on Saturday, November 1, 1941, and boiled for approximately 2½ hours.

(*b*) Boned in the galley from 3 p. m. to 7 p. m.

(*c*) Allowed to cool thoroughly in uncovered dish pans from 7 p. m. to 10:30 p. m., when they were put in ice box, temperature 40° F.

(*d*) On Sunday, November 2, chickens were drawn out at 8 a. m. and chopped until 10 a. m.

(*e*) Chicken stood in the galley until 10:45 a. m., when it was creamed, using butter, fresh milk, flour, potato water, and hot soup stock.

(*f*) The last 150 rations were prepared with new cream sauce at 12:30 p. m. Canned milk was substituted for fresh milk, otherwise the ingredients were the same.

(*g*) Chicken for last 150 rations came from two new aluminum pans which had previously been used only a few times.

(*h*) The chicken was prepared on the U. S. S. *Wilmette* and carried to the steam tables of the mess hall. a distance of approximately 75 feet. This method of preparing and serving food is not ideal but is the best method available.

Other foods served at the noon meal on Sunday were mashed potatoes, peas, fresh tomato salad, bread, butter, ice cream, and coffee.

Sixty-six cases were admitted to the sick bay, the first case at 1 p. m.

Symptoms in the majority of cases were pallor, abdominal distress, and violent vomiting followed by persistent retching and diarrhea. A mild degree of shock with cold, clammy skin; rapid and weak pulse; and hypotension was noted. Two cases were sent via ambulance to the United States marine hospital, Chicago, Ill. Most of the men described their symptoms as a sudden "grabbing" of the stomach as though someone had taken hold of it and squeezed it. The cramp was immediately followed by a sense of nausea and a desire to vomit. Shortly thereafter, the desire to defecate developed and could not be restrained. Many were at recreational centers in the city at the time but in no case was food or drinks taken on shore which might have caused the attack. Symptoms appeared about the same time among the men aboard and those ashore. So many were prostrated upon admission that it was impossible to thoroughly examine each case. No previous disease or disturbance had been noted. The majority were brought to the medical officer by city ambulances and station wagons within an hour after development of symptoms.

Samples of the creamed chicken, mashed potatoes, canned peas, hot water, ice cream, butter, canned milk, and an unopened can of peas were sent, in sterile containers to the Chicago Health Department for analysis. No report from that department is available at this time. All water used on the U. S. S. *Wilmette* is taken from the Chicago mains and hot water is developed by steam. The fire mains of the U. S. S. *Wilmette* are used to wash the deck.

It was reported to the medical officer that some of the chicken stood in stock pots after being boiled and that the depth of the meat was considerably more than the stated 8 inches. The Chicago Board of Health took samples of water and made a thorough check of the plumbing facilities.

Gastroenteritis, acute—Section base, Newport, R. I.—(Special report dated January 12, 1942).—A localized outbreak of illness, of undetermined cause, occurred on board the U. S. S. *Hazel* between December 30, 1941, and January 4, 1942. Thirty-one men were affected as follows:

```
December 30_____  14
January  1_____  13
January  2_____   1
January  3_____   2
January  4_____   1
```

Three of the cases were transferred to the United States naval hospital, Newport, R. I. No definite diagnosis was made.

Onset of illness was sudden. It began with upper abdominal pain or discomfort, followed shortly thereafter by vomiting one, two, or three times. This was followed during the next 3 or 4 days by malaise, generalized crampy abdominal pains, weakness, fatigue, muscle aches (especially in the lumbar region), loss of appetite, and frequently by headache and dizziness. About one-third had mild upper respiratory infections and four or five had mild diarrhea. Most of the patients showed a rise in pulse, between 90 and 120, but only two showed rise in temperature, highest 99.6° F. All showed strikingly similar symptoms and course. Physical examination was negative in all cases except for generalized abdominal tenderness. The average duration of the illness from time of onset to the disappearance of all symptoms was 3 days. A few were well after 24 hours. The longest illness was 7 days. None were severly ill, but all were partially incapacitated.

Food and milk were examined and nothing unusual found. The sources of supply of food and milk are identical with those from which the section base is supplied. No foods had been kept unduly long before being served.

The vessel filled its water tanks from the fleet wharf adjacent to the section base, and from the fuel and net depot in Melville. Samples of water from the Fleet wharf outlets and from the vessel itself were taken by the city of Newport water department. The water was found to contain no bacteria of the colon group, but it was found to have a high iron content (1.8 parts per million). This is an old water main from the street to the wharf and was found to be sound when examined during reconstruction period of the wharf. The iron content is gradually decreasing with use.

The second water sample, taken on January 4 just before the tanks were flushed out and refilled, showed a murky appearance and the presence of A. aerogenes, but no bacteria indicating sewage contamination. On January 2, following an emergency trip in extremely rough weather, the water on board was found to have a peculiar taste and odor. It is believed that sediment in the tanks was stirred up by heavy tossing about.

Summary:—Thirty-one men of the total complement on board the U. S. S. *Hazel* were affected with an illness of unknown cause between December 30, 1941, and January 4, 1942. The illness was primarily a gastro-enteritis in character. A few of the patients were confined to bed for 24 hours. The majority, however, were ambulatory.

General fatigue was believed to be a complicating factor.

Conclusions.—There seem to be two main possibilities as to cause:

(1) Some type of food or water poisoning.

(2) Some type of infectious disease disseminated by personal contact or proximity. No definite conclusions can be made with the

evidence on hand. No food has been found that might have caused the outbreak and the water analysis does not indicate any definite factor that might have been the cause. There was apparently some sediment in the water tanks which was stirred up by violent rolling of the vessel on January 2 and which caused the drinking water to have a peculiar taste and odor, but this was after the onset of the disease. The fact that about one-third of the vessel's complement had some form of upper respiratory infection suggests a nasopharyngeal portal of entry for the illness.

MENTAL AND PHYSICAL QUALIFICATIONS OF RECRUITS

Statistics for the quarter ending December 31, 1941

The following statistics were compiled from sanitary reports submitted by naval training stations.

October, November, and December	Eastern area	Northeastern area	Northwestern area	Western area
Recruits appearing before board of medical survey	140	50	228	113
Recruits recommended for discharge from the service	140	49	228	113
Recruits discharged by reason of medical survey	134	(¹)	(¹)	(¹)
Recruits held over pending further observation	111	7	650	59
Recruits transferred to the hospital for treatment, operation, or further observation for conditions existing prior to enlistment	(¹)	264	146	203

¹ Not reported.

The following table was prepared from reports of medical surveys in which disabilities or disease causing the survey were noted existing prior to enlistment. With certain diseases, survey followed enlistment so rapidly that it would seem that many might have been eliminated in the recruiting office.

Cause of survey	Number of surveys
Absence, acquired, teeth	7
Acne, vulgaris	1
Adhesions, pleural	1
Albuminuria	2
Amblyopia	6
Ankylosis	1
Anomaly	2
Arthritis, chronic	2
Asthma	7
Astigmatism, compound hyperopic	6
Astigmatism, compound myopic	6
Astigmatism, simple hyperopic	3

Cause of survey	Number of surveys
Astigmatism, simple myopic	6
Astigmatism, mixed	3
Atelectasis	1
Athetosis	1
Bromidrosis	1
Bronchiectasis	2
Calculus, kidney	1
Carcinoma, rectum	1
Cardiac arrhythmia, paroxysmal tachycardia	2
Cardiac disorder, functional	1
Carditis, acute	1
Caries, teeth	4
Cataract	1
Chorea	1
Cicatrix, skin	2
Color blindness	24
Constitutional psychopathic inferiority, without psychosis	11
Constitutional psychopathic state, criminalism	1
Constitutional psychopathic state, emotional instability	15
Constitutional psychopathic state, inadequate personality	7
Constitutional psychopathic state, paranoid personality	1
Contracture, muscle	1
Cryptorchidism	1
Curvature, spine	1
Cyst	2
Deafness, bilateral	4
Deafness, unilaterial	6
Defective physical development	1
Deformity, acquired	21
Deformity, congenital	7
Delirium, alcoholic	1
Dementia praecox	11
Deviation, nasal septum	4
Diabetes mellitus	1
Dislocation, articular cartilage	4
Dislocation, chronic, recurrent	2
Diverticulum, duodenum	2
Eczema	1
Encephalitis, chronic	2
Enterocolitis, chronic	1
Enuresis	12
Epilepsy	23
Fistula, neck	1
Flat foot	56
Foreign body, traumatic	2
Goiter, adenomatous	1
Gonococcus infection, prostate	1
Gonococcus infection, urethra	2
Hay fever	2
Headache	2
Heart disease, congenital	1
Hemangioma	1

Cause of survey	Number of surveys
Hemianopsia	1
Hemiplegia, old	1
Hernia, fascia	1
Hernia, inguinal, direct	1
Hernia, inguinal, indirect	9
Hernia, recurrent after operation	1
Hydrocele	1
Hydrocele, tunica vaginalis	2
Hyperopia	2
Hypertension, arterial	3
Hypothyroidism	1
Ichthyosis	1
Insufficiency, ocular muscle	1
Intracranial injury	3
Irritable colon	1
Joint, internal derangement of	3
Loss of substance, bone	1
Malocclusion, teeth	2
Mental deficiency, moron	4
Migraine	4
Myocarditis, chronic	1
Myopia	9
Myositis, chronic	5
Myxedema	1
Nephritis, chronic	8
Nephroptosis	1
Neuritis, optic	1
Neurosis, intestinal	3
Neurosyphilis, serological	1
Nostalgia	2
Osgood-Schlatter disease	3
Osteochondritis, deformans	4
Osteochondritis, dissecans	2
Osteochrondroma	1
Osteomyelitis	1
Otitis media, chronic	36
Pansinusitis	2
Paralysis, nerve	1
Paralysis, brachial plexus	1
Perforated nasal septum	1
Pes cavus	2
Pleurisy, fibrinous, chronic	5
Pneumonitis, chronic, no ituberculous	1
Pneumothorax	1
Poisoning, chronic, lead	1
Polypus, nasal	1
Post-traumatic, constitution	1
Prostatitis, chronic, nonvenereal	1
Pruritis, ani	1
Psoriasis	1
Psychoneurosis, anxiety neurosis	5
Psychoneurosis, hysteria	13

Cause of survey	Number of surveys
Psychoneurosis, neurasthenia	3
Psychoneurosis, psychasthenia	1
Psychoneurosis, traumatic	5
Psychoneurosis, unclassified	3
Psychosis, manic depressive	1
Purpura, hemorrhagica	1
Pyelitis, chronic	1
Pylorospasm	1
Rheumatic fever	1
Rhinitis, allergic	1
Rhinitis, atrophic	1
Sarcoma	1
Scleroderma	1
Seasickness	2
Sinus, chronic	1
Sinusitis, ethmoidal	4
Sinusitis, frontal	1
Sinusitis, maxillary	3
Somnambulism	1
Spasm, habit	1
Spur, bone	1
Strabismus	11
Strain, chronic	3
Syncope	1
Synovitis, chronic	3
Syphilis	2
Syphilis, sero-positive only	1
Tachycardia	1
Talipes	1
Tic	1
Tuberculosis, pulmonary, chronic, active	4
Tuberculosis, pulmonary, chronic, arrested	41
Tuberculosis, pulmonary, miliary, arrested	16
Tuberculosis, pulmonary, childhood type	11
Tuberculosis, pulmonary, joint	1
Ulcer, duodenum	6
Union of fracture, faulty	2
Urticaria	1
Valvular heart disease, aortic and mitral	1
Valvular heart disease, aortic insufficiency	1
Valvular heart disease, mitral insufficiency	16
Valvular heart disease, mitral stenosis	3
Valvular heart disease, pulmonic	1
Varicocele	4
Varicose veins	3
Total	**638**

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United States
Naval
Medical Bulletin

PUBLISHED *for the* INFORMATION OF THE
MEDICAL DEPARTMENT *of the* NAVY

Dental Number

THE MISSION OF THE MEDICAL CORPS OF THE NAVY

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TO KEEP AS MANY MEN AT AS MANY GUNS
AS MANY DAYS AS POSSIBLE

UNITED STATES
NAVAL
MEDICAL BULLETIN

FOR THE INFORMATION OF
THE MEDICAL DEPARTMENT OF THE NAVY

⚓

DIVISION OF PUBLICATIONS
THE BUREAU OF MEDICINE AND SURGERY

Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

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Volume XXIV, 1926, Nos. 1 and 4.
Volume XXV, 1927, No. 1.
Volume XXVII, 1929, Nos. 3 and 4.
Volume XXVIII, 1930, Nos. 1 and 3.
Volume XXXIII, 1935, No. 3.
Volume XXXIV, 1936, Nos. 1, 2, and 4.
Volume XXXV, 1937, No. 1.
Volume XXXVI, 1938, No. 1.
Volume XXXVIII, 1940, Nos. 1 and 3.

II

PREFACE

THE UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907, as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of appreciation to authors of papers of outstanding merit.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T McINTIRE,
Surgeon General, United States Navy.

III

NOTICE TO CONTRIBUTORS

Contributions to the BULLETIN should be typewritten, double spaced, on plain paper and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication. For example, addresses, dates, etc., not a part of the article, require deletion by the editor. The BULLETIN endeavors to follow a uniform style in heading and captions, and the editor can be spared much time and trouble, and unnecessary changes in manuscript can be obviated if authors will follow in these particulars the practice of recent issues.

The greatest accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible for the editor to understand or verify references, quotations, etc. The frequency of gross errors in orthography in many contributions is conclusive evidence that authors often fail to read over their manuscripts after they have been typewritten.

Contributions must be received at least 3 months prior to the date of the issue for which they are intended.

The editor is not responsible for the safe return of manuscripts and pictures. All materials supplied for illustrations, if not original, should be accompanied by reference to the source and a statement as to whether or not reproduction has been authorized.

The BULLETIN intends to print only original articles, translations, in whole or in part, reviews, and reports and notices of Government or departmental activities, official announcements, etc. All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere without an understanding to that effect and that editorial privilege is granted to this Bureau in preparing all material submitted for publication.

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SPECIAL ARTICLES

A SHORT HISTORY OF THE UNITED STATES NAVAL DENTAL CORPS

By Lieutenant Commander Carl August Schlack, Dental Corps, United States Navy

The earliest evidence of naval appropriation for denistry was the authorization, by act of Congress, March 3, 1883, of $1,600 for the services of one dentist at the Naval Academy. Dr. H. Walton, as far as can be determined, had been serving in the capacity of civilian dentist at the academy since 1876. He had the same status as the civilian instructors teaching them but not forming a part of the Navy. Dr. Walton served until 1899, when Dr. Richard Grady took his place. He had no commission and was not considered as part of the Medical Department. Rightfully, he can be considered the father of United States naval dentistry. Prior to this evidence of the conscious need of dentists in the United States Navy, the personnel was forced to seek the services of civilian dentists. Where urgent emergency dental treatments were required while at sea, or in ports having no dentists, they were usually handled by the medical officer. The nature of the treatment was, of course, very meager and limited to extractions.

In Surg. Gen. P. M. Rixey's report of October 1, 1902, he mentioned the need for qualified dentists for the personnel of the Navy, especially in the outlying naval foreign establishments and the large establishments in the United States. A bill was introduced at the session of Congress that year (1902) to authorize employment of contract dentists for the Navy at stations previously mentioned. The dentists were to undergo an examination and to be selected by, as well as to come under the jurisdiction of, the Bureau of Medicine and Surgery. It was not considered by Congress then. Agitation for the establishment of a dental corps in the Navy was seriously undertaken, especially in view of the fact that Congress had passed an act in 1901 permitting the Army to employ contract dentists and made no such provision for the Navy.

During the year 1903, hospital stewards having training and experience in dentistry were assigned to the training station at Newport, on the receiving ship, *Columbia*, and to the naval station at Guam. Arrangements for a like service were being made on the receiving ships, *Wabash* and *Franklin*. The type of dentistry was not considered satisfactory to the Bureau, just to the men, nor pleasing to the dental profession, even though some measure of dentistry could be accomplished. Earnest recommendations again to the effect of employing contract graduate dentists for the personnel of the Navy were made that year, but again not considered by Congress.

A plan was formulated in 1904 whereby one graduate dentist for every 1,000 Navy and Marine personnel (not to exceed 30 dentists in all), was to be appointed under the terms and conditions applicable to acting assistant surgeon in the Navy. These dentists were to enter competitive examinations prescribed by the Surgeon General of the Navy.

An increased number of hospital stewards with some knowledge of dentistry were being pressed into performing dental services during these years. Mention is made in the Surgeon General's Report of October 1, 1904, of a few hospital stewards with dental qualifications rendering dental treatment on board the receiving ships, *Hancock*, and *Franklin*, at the training station, San Francisco, Calif., and the naval station, Cavite, P. I. Since the dental supplies furnished by the Bureau were limited, only simple procedures and urgent cases could be watched and treated. The first graduate dentist to enlist in the Navy as a hospital steward performing dental service exclusively to the personnel was Dr. E. E. Harris, who graduated from one of the dental schools in Chicago in 1904. The pay received by hospital stewards was considered inadequate compensation for the services of qualified dentists who were hospital stewards. It, therefore, could not be hoped that they would remain beyond their first enlistment. This resulted in a continuous turnover of hospital stewards performing dental services, few as they were in number, with obvious unsatisfactory sequelae.

The House Naval Committee at the last session of Congress in 1904 reported favorably upon and recommended passage of a House Bill numbered 18722 embodying the principles for which Surgeon General Rixey was striving. It again failed consideration by Congress, however. Contract dentistry was again urgently requested by the Surgeon General, especially in view of the fact that by an act of Congress dated February 2, 1901, 30 such dental surgeons were permitted to the Army.

In 1910 the senior medical officer of the *Minnesota*, whose junior medical officer was a graduate in dentistry as well as medicine, reported:

Excellent work in the dental department, especially in temporary preservation of the teeth, has been done by Asst. Surg. L. W. Johnson. In addition to the

usual dental outfit supplied, dental supplies on requisition and the use of his own instruments have enabled him to do considerable work in this line, not only on this ship, but on many cases sent from other ships. He has used ethyl chloride by the closed method as a general anaesthetic, not only for the extraction of teeth, but in opening abscesses, the breaking up of adhesions around joints, and in other short minor operations. No untoward symptoms resulted from the administration of ethyl chloride in any case. Doubtless in ·the Navy many teeth that can be temporarily filled are sacrificed for the relief of toothache.

The first article on dentistry that appeared in the United States Naval Medical Bulletin, since its publication in 1907, appeared in the April issue of 1910.[1]

The need for dental attention in the Navy became so urgent that during Surgeon General Rixey's administration, particularly, numerous attempts were made to obtain the passage of a bill to establish a dental corps. This was not, however, accomplished until 1912, during the administration of Surgeon General Stokes. The Act of Congress dated August 22, 1912, and signed by President Taft, established the United States Naval Dental Corps. This basic legislation was of such interest and importance in the history of the Dental Corps of the Navy that it is reproduced here in its entirety:

That the appointment of not more than thirty assistant dental surgeons be, and the same is hereby authorized, said assistant dental surgeons to be a part of the Medical Department of the United States Navy, to serve professionally the personnel of the naval service, and to perform such other duties as may be prescribed by competent authority.

That all original appointments herein authorized shall be made by the Secretary of the Navy in the grade of acting assistant dental surgeons, and all appointees to such grade shall be citizens of the United States, between twenty-four and thirty-two years of age, and shall be graduates of standard medical or dental colleges trained in the several branches of dentistry, of good moral character, of unquestionable professional ability, and before appointment shall pass a satisfactory physical and professional examination including tests of skill in practical dentistry, of proficiency in the several usual subjects in a standard dental college course, and in such other subjects of general education as are now or may hereafter be required for admission to the Medical Corps of the Navy.

That at the end of three years from the passage of this act all acting assistant dental surgeons who have two or more years' service under their original appointment as herein provided, shall undergo such physical and competitive professional examinations as the Secretary of the Navy may prescribe to determine their fitness to receive commissions in the Navy, and if found qualified in all respects they shall be appointed assistant dental surgeons, with the rank of Lieutenant (junior grade), in order of standing as determined by the professional examinations provided for in this Act.

That after the competitive examinations provided for in section three of this Act have been held, acting assistant dental surgeons thereafter appointed shall serve a probationary period of three years, and upon completion of such period shall undergo such examinations as the Secretary of the Navy may prescribe

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[1] This was an abstract made by Asst. Surg. L. W. Johnson reviewing papers on the subject "Vaccine Treatment of Pyorrhea Alveolaris" by Goadby (Lancet, December 25, 1909) and Medalia (Boston Med. and Surg. J., January 18, 1910).

to determine their fitness to receive commissions in the Navy, and, if found qualified, they shall be appointed assistant dental surgeons with the rank of Lieutenant (junior grade).

That if any acting assistant dental surgeon shall fail upon the examinations prescribed in this Act he shall be honorably discharged from the naval service, and the appointment of an acting dental surgeon may be revoked at any time in the discretion of the Secretary of the Navy.

That all appointees authorized by this Act shall take rank and precedence in the same manner in all respects as in the case of appointees to the Medical Corps of the Navy, and shall not exercise command over persons in the Navy other than dental surgeons and such enlisted men as may be detailed to assist them by competent authority.

That all officers of the Dental Corps authorized by this Act shall receive the same pay and allowances as officers of corresponding rank and length of service in the Medical Corps of the Navy.

That all officers of the Dental Corps authorized by this Act shall be eligible to retirement in the same manner and under the same conditions as officers of the Medical Corps of the Navy: Provided, That section fourteen hundred and forty-five of the revised Statutes of the United States shall not be applied to the officers therein authorized: And provided further, That the dentist now employed at the Naval Academy shall not be displaced by the operation of this Act and he shall have the same official status, pay, and allowances as may be provided for the senior dental surgeon at the Military Academy.

That, The Secretary of the Navy is hereby authorized to appoint, for temporary service, suitably qualified acting dental officers when necessary to the health or efficiency of the personnel of the Naval Service: Provided, That the total strength of the Dental Corps, including those appointed for temporary service under this Act, shall not exceed the proportion of one to each thousand of the authorized enlisted strength of the Navy and Marine Corps: Provided further, That appointments issued under authority of this Act may be revoked at any time, shall have no legal force or effect except for the time temporary appointee is in active service, and shall include no right of retirement.

That all appointments authorized by this Act, except the appointment of acting dental surgeons, shall be made by the President by and with the advice and consent of the Senate.

That all laws and parts of laws inconsistent with the provisions of this Act be, and the same are hereby, repealed: Provided, That the tests of qualifications for appointment to the said reserve corps and to the Dental Corps may be varied to suit the subjects of such branch of the healing art or specialty of surgery of which specialists may be required and in the discretion of The Secretary of the Navy such specialists may be grouped separately: Provided, further, That of the dental surgeons hereby authorized to be appointed to said Medical Reserve Corps and to the said Dental Corps, the whole number ordered to active duty shall not exceed the number The Secretary of the Navy may deem actually necessary to the health and efficiency of the personnel of the Navy and Marine Corps, and in time of peace, the number shall not exceed the proportion of one dental officer to one thousand of said personnel * * *.

The first original article by a member of the Dental Corps to appear in the Naval Medical Bulletin was that by Acting Asst. Dental Surg., P. G. White, United States Navy, entitled, "Succinimid of Mercury in Pyorrhea Alveolaris, a Preliminary Report." It appeared in the October issue of 1914.

Various acts of Congress modified the original Act, and that of August 29, 1916 created the ranks of lieutenant and lieutenant commander in the corps. In 1926 legislation provided for the promotion of dental officers, as other staff officers, with the running mate in the line. This gave well merited recognition and prestige to the Dental Corps and afforded promotion, as it did, up to the rank of captain.

During 1923, the Dental Division in charge of a dental officer, as part of the organization of the Bureau of Medicine and Surgery, was established. This division to have cognizance of all dental affairs in the Navy and to have charge of the administration, under the direction of the Surgeon General, of all technical activities pertaining to the Dental Corps, including personnel, material, and inspection. A system of inspection of the dental activities on board ship by the senior dental officer in each fleet was established to coordinate the dental department of each vessel and instill better supervision.

In 1935 Congress increased the ratio of dental officers. It is now one to every 500 in the Navy and Marine Corps.

Another landmark in the history of the Dental Corps was the establishment of the Naval Dental School in 1936. This school formed a part of the Naval Medical Center and was under the jurisdiction of the Commanding Officer of the Naval Medical Center and administered in the same manner as the Naval Hospital and Naval Medical School. Commander J. V. McAlpin, Dental Corps, United States Navy, was placed in command of the school—the first time a dental officer exercised command of a naval establishment.

It is of interest that the first commissioned officer of the United States Navy to meet death during land fighting overseas in the World War was a dental officer. Asst. Dental Surg. W. E. Osborne was killed on June 6, 1918 at Chateau Thierry, France while attending a wounded officer. The Distinguished Service Cross and the Congressional Medal of Honor were awarded to him posthumously.

ORAL SURGICAL ROUTINE AT THE UNITED STATES NAVAL DENTAL SCHOOL [1]

By Lieutenant Commander R. W. Taylor, Dental Corps, United States Navy

As the title indicates, this paper deals with the various technics and procedures as taught in the United States Naval Dental School. At the present rapid rate of expansion, it will be impossible for all new members of the Dental Corps to attend the school. It is hoped that this review will be of some practical value to those sent directly to the various dental activities.

In the practice of dentistry, oral diagnosis plays an important role. The dentist not only assumes the responsibility of diagnosing and treat-

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ing oral lesions, but must be ever alert to detect local oral manifestations of a systemic origin, in order that the patient may be referred to the physician for proper medical attention.

A patient reporting to a naval hospital may be assigned directly to the dental department as a dental case, or, having been admitted to other services, may eventually reach the dental clinic for consultation. In either case, a careful oral examination and detailed case history report is indicated as the first essential. In addition, the dental surgeon should familiarize himself with the contents of the patient's clinical record. When admitted to a naval hospital, every patient undergoes general physical and various laboratory examinations. This data is recorded in his clinical record. Often, a general physical examination may throw considerable light upon the nature of an otherwise obscure local oral condition.

The diagnosis of a disease or lesion present in the oral cavity may be established at the first examination. Occasionally, however, additional time is required for the further study of the case and clarification by a differential diagnosis.

The general physical appearance of the patient should be observed. Cachexia of rather late malignant disease is suggestive. The clinical appearance of a patient suspected of leukemia may indicate the advisability of a complete blood examination.

The patient should be permitted to give his own account of the present complaint. Many important subjective, as well as objective symptoms, will be presented, all of which the careful dentist cannot afford to overlook if he is to arrive at a correct diagnosis. In questioning the patient, the dentist should determine when and how the complaint began. If swelling is present, he should inquire as to the duration, the increase or diminution in size, the pain or tenderness experienced, and whether or not the lymph glands are involved. If there is a discharge, he should determine the nature of the exudate. If the complaint is an unusual stomatitis, he should find out if it made its appearance at the same time as other lesions which might appear on the skin, or if it followed the administering of drugs or a change of diet or habits. As these questions are being asked, the dentist is considering various possibilities, such as allergic reactions to certain drugs or foods. The stomatitis may be a local manifestation of diabetes, or perhaps syphilis in one of its many forms. It may also be the result of an avitaminosis or fungus infection, etc.

In the oral examination, it is well to begin with a study of the face. Note its symmetry and the presence of any lesions on the lips. Palpation of the glands of the head and neck is always indicated. Examine the oral mucous membranes for any deviation from the normal. There must be a careful exploration of the teeth and surrounding tissues with

a fine instrument. Percussion of the teeth and their reaction to the vitality test should not be overlooked. No examination of the oral cavity is entirely complete without a radiographic study.

The importance of thoroughness in an examination cannot be over-emphasized. In this connection, dental officers should make use of the fine laboratory facilities available in the Navy. In many cases, it is essential that bacteriologic and histopathologic studies be conducted. Biopsy should be resorted to more frequently. In the field of oral diagnosis and surgery, all tissue of a doubtful nature must be sent to the laboratory for thorough study. The only equipment necessary for this added precaution is a bottle containing a 10 percent solution of formalin. The tissue is placed in this solution immediately upon its removal. A brief history, including the age of the patient, the gross appearance, duration, location and clinical diagnosis of the lesion must accompany it. In this manner, the dentist collects his clinical evidence, which, with laboratory findings, will aid in making a differential diagnosis.

The routine intra-oral surgery cannot be accomplished under aseptic conditions in the true sense of the word because of many factors beyond the dental surgeon's control. However, he must make every effort to minimize the introduction of foreign organisms into the wound. This may be accomplished by a conscientious attempt to maintain an aseptic technic even though the chain of asepsis is inevitably broken. The inability to completely sterilize the mucous membrane of the operative site, the hands of the operating personnel, as well as the failure to adequately isolate the field of operation, constitute the weakest links in the chain of an aseptic technic. Experience has shown that, by a zealous adherence to aseptic principles, the number of bacteria from these sources can be sufficiently diminished so that the defense mechanism inherent within the body tissues may successfully cope with this minute contamination. Prevention of wound contamination must ever be the paramount objective in all surgical procedures, because infection endangers the life of the patient and may ruin the most skillfully executed operation.

It is a well established fact that the nares and mouths of members of the operating personnel are prolific sources of wound infection. Pathogenic bacteria, including streptococci, staphylococci, and pneumococci, may be constantly present in the mouths of even healthy individuals. These organisms, although harmless to their host, may incite infection when transferred to an open wound. The bacteria gain entrance to the wound by way of droplets of saliva expelled during respiration or speech. Masking the nares and mouths of operating personnel is an important measure in the prevention of this source of infection.

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Preparation of the hands is governed by the same aseptic principles as sterilization of the operative field. The hands, forearms and lower third of the arms are scrubbed with soap and water. The fingernails are cleaned and hands again scrubbed well with soap and water. They may then be immersed in 70 percent alcohol, dried with a sterile towel and covered with sterile rubber gloves. The gloves not only protect the patient but guard the operator against infection. In the routine extraction of teeth, it is unnecessary to change gloves for each patient. The gloved hands may be scrubbed well with soap and water, then immersed in 70 percent alcohol.

Mucous membranes are prepared for surgery by irrigating with a mild antiseptic agent. An oral prophylaxis as a preoperative measure is indicated in many cases. If a local anesthetic is to be used, the site of the needle insertion is well dried and the mucous membrane painted with an antiseptic solution. Unless this is done, a sterile needle, when inserted, would become a contaminated one and might carry bacteria along its pathway into the deeper structures.

The complete isolation of the field of operation is a difficult accomplishment in the oral cavity. There are certain areas which can be blocked off successfully during the operation. For example, when performing an apicoectomy on a maxillary anterior tooth, the field is isolated in the following manner. Several 3 by 3 sterile gauze packs are placed anteriorly between the dental arches and the patient is instructed to close lightly on them. Then, additional gauze packs are placed between the cheek and buccal surfaces of the teeth, bilaterally. By this means, the labial surfaces of the maxillary anterior teeth and surrounding soft tissues are blocked off from the rest of the mouth. The field of operation and lips are sterilized, thus, aseptic surgery of the oral cavity approaches reality. It may be added that all sponges, dressings, and towels used on the patient and those covering the bracket table should be autoclaved.

A full complement of instruments is either placed in the autoclave or boiled. These instruments include rongeurs, bone files, periosteal elevators, forceps, root elevators, curets, hemostats, retractors, probes, etc. Instruments such as scalpels, chisels, scissors and needles are placed in concentrated phenol for 30 minutes, followed by immersion in 70 percent alcohol.

A reserve instrument table is covered with a sterile towel or field cloth. The instruments are then removed from the sterilizer with a sterile instrument forceps and dried with a sterile towel. Care must be taken that the hands do not come in contact with the instruments. If the instruments have been autoclaved it will not be necessary to dry them with a towel. These instruments are then placed on the reserve table and covered with a sterile towel. The bracket table is

also covered with a sterile towel or field cloth. The instruments are transferred as needed from the reserve table to the bracket table with a sterile instrument forceps. Upon completion of the operation, the instruments on the bracket table are scrubbed in cold water to remove the blood and are then either boiled or autoclaved. Following this, they are returned to the reserve instrument table. Each morning, all instruments on the reserve table are resterilized. This technic of instrument sterilization is employed at the United States Naval Dental School and is very satisfactory.

The following method has proved very practical aboard ship where space is limited and the surgical instruments are not in constant use. Instruments are grouped as desired by the operator and placed in various trays. A small piece of adhesive tape is fastened to each tray containing a list of the instruments in the tray. The trays are covered with a towel and autoclaved. In this way, sterile instruments are always available for instant use.

In the preparation of procaine solution, the syringes, needles and porcelain cups are placed in the sterilizer and boiled for 20 minutes. They are then removed from the sterilizer with a sterile instrument forceps and placed upon a sterile towel. The porcelain containers are then filled with sterile distilled water and boiled for several minutes. A small amount is drawn into the various syringes and expelled. The bottle containing the procaine tablets is wiped with alcohol and with the aid of a sterile sponge, the stopper is removed. The necessary number of tablets are allowed to drop directly from the bottle into the distilled water contained in the porcelain cups. The distilled water and tablets are again boiled for a short period. The syringes are then filled and placed under a sterile towel. An adequate supply of solution is prepared in advance so as to be instantly available. If procaine solution is left exposed to the air for a short period of time, it becomes discolored, indicating adrenalin decomposition. However, after the solution has been placed in the syringes, it will remain for a considerable length of time without exhibiting the slightest evidence of discoloration. Experimental work performed at the Naval Dental School revealed the fact that the contents of the syringes prepared in the above manner were sterile after an elapsed period of 30 days. However, in the clinics of this institution, fresh solutions are prepared each morning.

The operative field of dentistry extends posteriorly to the tonsillar region. In comparing a tonsillectomy with the removal of an impacted mandibular third molar tooth, the latter operation involves bone in addition to soft tissue. Postoperative infection following the removal of either teeth or tonsils may equally jeopardize the life of the patient. The physician who specializes in this particular branch of medicine,

carries out an aseptic technic when performing a tonsillectomy. The dentist, too, is fully aware of his responsibility of adopting the same aseptic surgical procedure when operating within the oral cavity.

While instrument sterilization is of paramount importance, the personal equation must not be overlooked. The patient is a human being with a complex nervous system who approaches the dental chair with more or less dread and trepidation. A word of sympathy or assurance that the operation will be performed as painlessly as possible, will fortify the mental attitude, and inspire confidence and appreciation in many. However, there are certain tense, nervous individuals beyond the power of normal persuasion. For these patients, premedication is indicated. Nembutal 1½ to 3 grains or sodium amytal 3 to 6 grains, given ½ hour before the operation is usually quite satisfactory.

Sulfanilamide is used routinely at the United States Naval Dental School following the removal of teeth, and results obtained have been most gratifying. Five grain tablets are broken into small fragments and inserted into the alveolus immediately following the extraction of the tooth. (The use of a sterile amalgam carrier has been found to be very helpful in introducing sulfanilamide into the alveoli of the maxillae). A sterile sponge is then placed over the alveolus and the patient is asked to bite on the sponge. This pressure is maintained for 30 minutes. Clinically, sulfanilamide does not interfere with the formation of a normal blood clot.

There are occasions when the use of an iodoform or gauze pack is indicated. However, the indiscriminate use of the gauze pack and especially the practice of routinely packing every alveolus following the extraction of a tooth, should be discouraged. The gauze interferes with the formation of the normal blood clot and, in the fresh wound, has very little value for the control of pain. In the majority of cases, postoperative pain may be alleviated by administering ½ grain codeine and 10 grains aspirin, as needed. Patients should be seen daily for postoperative treatment.

It is fully appreciated that the above does not cover in every detail, all problems confronting the naval dental surgeon. However, it is felt that application of the fundamental principles mentioned, facilitates a more adequate naval dental service.

The oral surgeon * * * should cultivate a sympathy for patients, especially those in great discomfort due to pain. He must study the various psychologic and pathologic meanings of pain. In balancing his knowledge of both, he will approach an ideal. Without this ideal to serve humanity, no oral surgeon or exodontist, no matter how well he masters his art, may aspire to become a truly great surgeon.—Operative Oral Surgery, Winter.

THE USE OF HUMAN ALBUMIN IN MILITARY MEDICINE [1]

Part I

THE THEORETICAL AND EXPERIMENTAL BASIS FOR ITS USE [2][3]

By James T. Heyl, M. D., and Charles A. Janeway, M. D. With the technical assistance of Anne Shwachman and Ladislas Wojcik

Blood plasma is an extremely complex fluid (1). Its diffusible constituents are essentially those of the interstitial fluid. However, plasma has special properties conferred by its proteins because they are present in significantly high concentrations and are relatively non-diffusible. The physiologic effect of these proteins upon blood volume has been the subject of many investigations in recent years and has provided experimental justification for the use of pooled plasma in the treatment of a depleted blood volume. Yet the plasma proteins can themselves be separated into chemical subdivisions which serve distinct functions (2). It is customary to discuss them in two main groups: the albumins and the globulins.

Albumin makes up about 62 percent of the total protein of human plasma. Chemically, it is the most soluble and most stable of the plasma proteins. By virtue of its smaller molecular weight and greater net charge, it is more important than globulin in maintaining the colloid osmotic pressure of the plasma. This pressure is the principal force counteracting filtration pressure. Albumin thus plays a major role in maintaining the volume of fluid in the blood stream. As a result of its molecular symmetry, albumin makes a less viscous solution than the other proteins, and therefore can be readily injected in concentrations of 25 percent. The advantage of plasma over solutions of salt and glucose in the treatment of shock depends on the osmotic pressure exerted by its proteins, and chiefly by albumin, which keeps fluid in the circulation at a time when protein is being lost faster than it can be synthesized. Thus the rationale of using albumin becomes clear. Neither plasma nor albumin supplies the hemoglobin of whole blood. Nor can solutions of albumin substitute for whole plasma indefinitely, since they lack its other essential protein constituents. But in the emergency treatment of shock, albumin offers distinct, practical advantages because it is stable, compact, and ready for instant use. Although pooled plasma, like albumin, can be administered without preliminary cross-matching, its instability, ease of contamination, and bulk in liquid form have been problems; in the dried state its technical production,

reconstitution, as well as bulk, have presented difficulties. Nevertheless, plasma has proven extremely useful clinically in either form. The purpose of this report is to present experimental evidence that albumin is not only a convenient but an effective substitute for plasma, in restoring a depleted blood volume.

The globulins are a large and heterogeneous group of proteins including prothrombin, fibrinogen, complement, antibodies, enzymes, and hormones. Two mechanisms in which globulins play a part are of significant importance in conditions associated with the loss of blood or plasma: namely, clotting of blood and resistance to infection conferred by antibodies. The source or rate at which antibodies and complement can be added to the circulation is not definitely known; hence the absence of these important globulins from concentrated albumin solution constitutes one theoretical limitation to its use as a substitute for plasma in very large quantities.

The mechanism of blood clotting depends upon two globulins, fibrinogen and prothrombin, as well as the calcium ion and thrombokinase from the blood platelets or tissue juice. Fibrinogen under the influence of thrombin, derived from prothrombin, is rapidly converted into fibrin, the framework of a blood or plasma clot. Although fibrinogen and prothrombin are present in only low concentration in the blood, both these proteins are synthesized predominantly, if not wholly, in the liver, and in conditions of normal blood flow can apparently be rapidly added to the blood stream (3) (4). Furthermore, their relatively low concentrations may be reduced considerably without significantly affecting the clotting mechanism (5) (6) (7) (8). The absence of prothrombin and fibrinogen in an albumin solution, therefore, contributes to its stability but limits its prolonged use in a particular patient, unless the ability to regenerate fibrinogen and prothrombin is shown to be adequate.

The preparation of a single plasma protein for a specific clinical need is due to the work of Prof. Edwin J. Cohn and his associates, L. E. Strong, J. L. Oncley, S. H. Armstrong, W. L. Hughes, J. A. Leutscher, and T. L. McMeekin, who have devised methods for the large-scale preparation of individual plasma proteins in a highly purified state (9). Their albumin solutions have been used in these experiments. All the experimental and clinical work recorded in the succeeding paragraphs is but the logical outcome of their fundamental studies on the chemical properties of the plasma proteins.

Because the urgent demands of treatment in clinical cases of shock preclude detailed study, it seemed important to evaluate the physiologic effects of human albumin solutions in man under carefully controlled conditions of a blood volume depletion by venesection. The first experiments with albumin in human beings were performed by Drs. Eugene A. Stead, Jr. and Richard V. Ebert; we have continued

with almost exactly the same technic as part of a series of investigations on shock, carried on in this clinic under the direction of the late Dr. Soma Weiss.

Normal subjects were admitted to the hospital one evening. The following morning the plasma volume was determined by the Evans blue dye method (10) (11). Following this, a rapid venesection of approximately 15 percent of the blood volume was performed, the amount withdrawn being carefully measured, and immediately thereafter the injection of concentrated (25 percent) albumin was begun. One hour after injection the plasma volume was again determined. The trend of the plasma volume was followed by frequent determinations of the
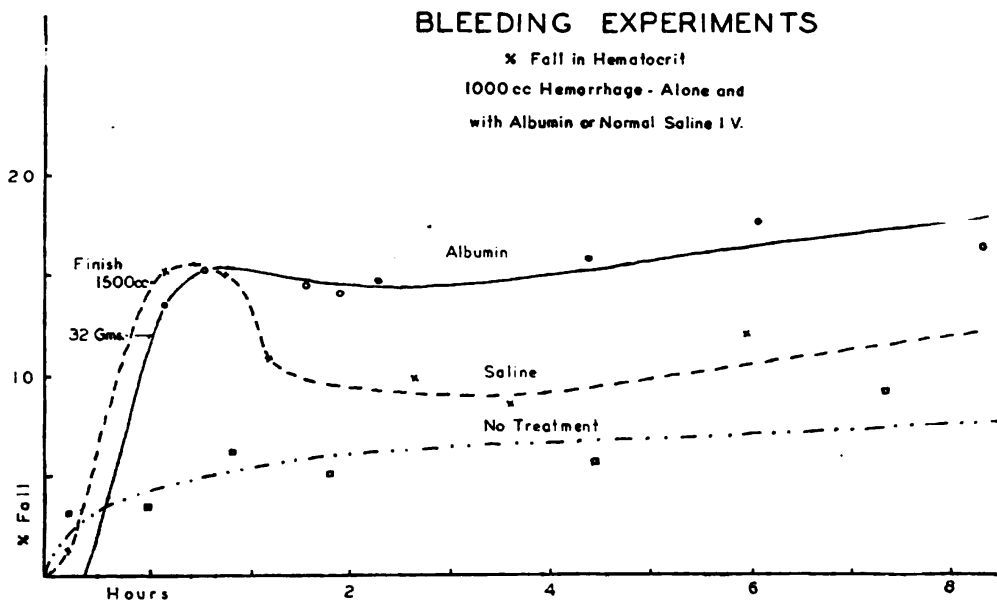
FIGURE 1.—Hematocrit readings after venesection of 1,000 cc. Compare the slow response in a control given no treatment, the temporary hemodilution produced by saline, and the rapid, but lasting hemodilution produced by concentrated human albumin intravenously.

values for hemoglobin, hematocrit reading, and total protein. The subjects were closely watched throughout the next 2 days, and their blood regeneration, serum proteins, and clinical condition studied for several months.

Control studies by Ebert, Stead, and Gibson (12) had already shown that in the first 2 hours after such hemorrhages, a slight increase of the plasma volume resulted from the addition of protein-poor fluid. From then on the increase in plasma volume was slow but steady, as protein-rich fluid was added to the circulation, until a maximum hemodilution was reached in 2 or 3 days. Saline infusions produced prompt hemodilution, but this was not maintained more than 3 hours after the injection was stopped (figure 1).

We have given dried, reconstituted human plasma to one of our experimental subjects as a further control. This effectively increased the plasma volume as measured 1 hour after injection, and this increase was well maintained, in contrast to that produced by saline.

The injection of concentrated albumin solutions (25 percent) into subjects who had just been bled 700 to 1,000 cc. was at the rate of about 5 cc. per minute. It was followed by a very rapid fall in hemoglobin

RESPONSE OF A NORMAL HUMAN SUBJECT
AFTER VENESECTION OF 19.5% OF CIRCULATING BLOOD VOLUME
TO 32 GMS. OF HUMAN ALBUMIN I.V. 134 C.C. OF 24 GMS.%

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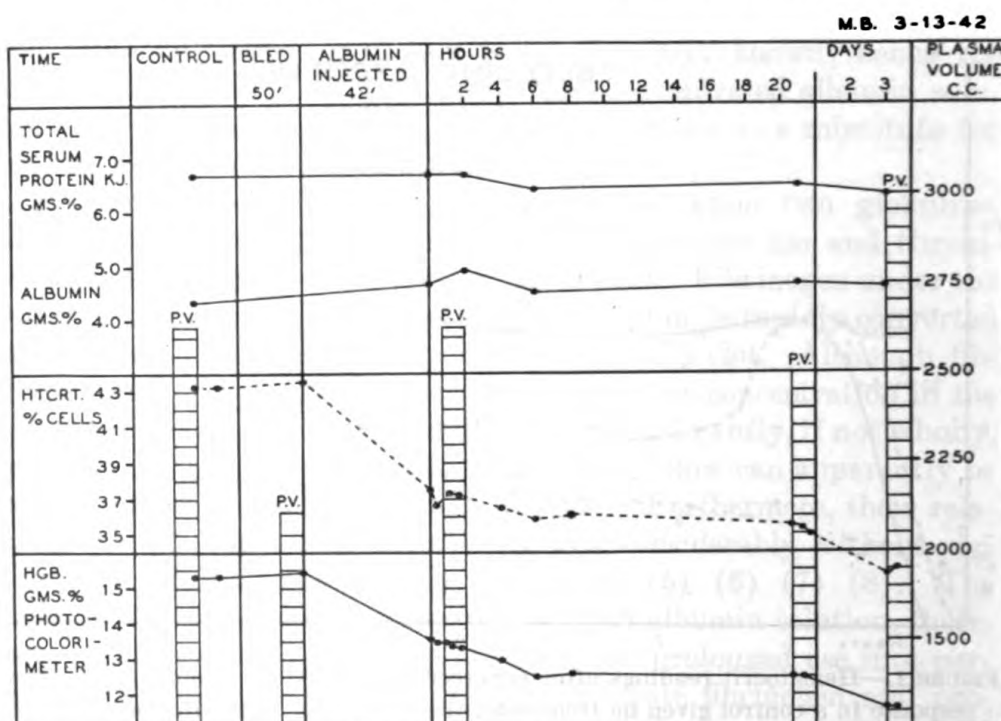
FIGURE 2.—The changes in plasma volume, total protein, hemoglobin and hematocrit in a subject given 32 gms. of concentrated human albumin after a rapid venesection of 925 cc.

and hematocrit reading (figure 1), with a slight rise in total protein, mainly the albumin fraction. The second chart (figure 2) illustrates the changes in one of the subjects. Most of the hemodilution had already taken place 15 minutes after the injection, although a slow drop in hemoglobin and hematocrit occurred during the next few hours. Determinations of the plasma volume 1 hour after injection demonstrated a constant increase, considerably greater than the volume of albumin solution injected, thus proving that the hypertonic solution had drawn fluid from outside the vessels into the circulation. The plasma volume after bleeding was calculated by subtracting from the initial volume the amount of plasma removed. The difference between this figure and the plasma volume determined 1 hour after injection

was taken as the amount of fluid added by the albumin injection. This was divided by the number of grams of albumin injected to estimate the volume of fluid added by each gram of albumin to the circulation. In different experiments this figure varied from 13.8 to 24 cc. per gram, with an average of approximately 18 cc. for a series of 9 experiments.

This figure is in good agreement with the value derived from *in vitro* studies of the osmotic pressure of whole serum and of serum albumin solutions being carried out as part of this investigation by Prof. George Scatchard with Alan C. Batchelder and Alexander Brown (13). They find that 1 gram of albumin is osmotically equivalent to 1.25 grams of plasma protein. Since the average plasma protein value for our subjects was 7.0 grams percent, a 5.6 percent albumin solution should be isosmotic with their plasma, and each gram of albumin would be expected to hold 18 cc. of fluid in the circulation.

This figure, which has been corroborated by our *in vivo* studies, forms the basis for the dosage unit. If each gram of albumin is capable of adding 18 cc. of fluid to the circulating plasma, then 25 grams should add approximately 450 cc. Thus, a 25-gram dose of albumin in buffered saline is about the equivalent of two units of dried citrated plasma, each of which contains the proteins from 225 to 250 cc. of plasma, diluted with 50 cc. of citrate solution.

It is necessary to point out that the errors inherent in the determinations on which our calculations are based are large, but the trends in different experiments are consistent, and the conclusion that concentrated albumin is effective in rapidly augmenting plasma volume seems quite valid.

There has been so much debate about the value and dangers of concentrated plasma that we were interested in looking for harmful effects (14) (15). Some experiments were performed with the subjects deprived of food and water for 15 hours before and 24 hours after bleeding. In other experiments the subjects were given 10 to 12 grams of salt and as much water as they could drink throughout. In neither group was there any significant difference in the immediate response to the injection of concentrated serum albumin. In the dehydrated subjects, there was a subsequent slow decrease in plasma volume with an increased concentration of both protein and cells until water was given. In the other group, the plasma volume continued to increase slowly after the immediate rise following albumin. Studies of serum and urine potassium failed to show significant deviations from the normal after the injection of concentrated albumin solution.[1]

Thus, the conclusion seems justified that the injection of albumin solutions of 25 grams percent concentration in doses of 30 to 35 grams,

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[1] The determinations of potassium were carried out by Miss E. A. MacLachlan under the direction of Dr. James L. Gamble.

even under conditions of relative dehydration, is not harmful and is effective in its purpose. However, it remains obvious that in the presence of severe dehydration concentrated solutions might be dangerous without the additional administration of the needed salt and water. There were no reactions to injections of this dosage at the rate of 5 cc. per minute.

SUMMARY

1. The theoretical basis for the use of albumin prepared from human plasma in the treatment of diminished blood volume is reviewed.

2. Quantitative observations upon subjects after blood depletion by venesection show that concentrated human albumin will rapidly augment the plasma volume by drawing fluid into the circulation.

3. Calculations from experimental data indicate that each gram of injected albumin (dose 30 to 35 grams) is capable of adding 14 to 24 cc. of fluid to the plasma, with an average in 9 subjects of 18 cc. at 1 hour after injection. This result confirms *in vitro* studies of osmotic pressure which form the basis for the standard albumin unit of 25 grams, which is therefore equivalent to about 450 cc. of circulating plasma or 500 cc. of citrated plasma.

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Part II

THE CLINICAL EVALUATION OF HUMAN ALBUMIN [1] [2]

By Lieutenant Lorande M. Woodruff, Medical Corps, United States Naval Reserve, and Lieutenant Sam T. Gibson, Medical Corps, United States Naval Reserve

In the preceding paper, concentrated albumin has been shown to be effective in maintaining or restoring blood volume. To establish evidence that it is safe and effective under clinical conditions, 200 patients have been given albumin to date. Of these, 51 were tests for reactions, 8 were experiments, while the remainder were clinical cases injected therapeutically.

PROCEDURE

The albumin used in this study was prepared under the direction of Dr. E. J. Cohn of the Department of Physical Chemistry, Harvard Medical School, by the methods developed by Cohn, Strong, Oncley, Armstrong, Hughes and their colleagues in the Harvard Plasma Fractionation Laboratory.

Before release for clinical use, preparations were tested for reactions in hospital patients with normal temperature charts. Those which proved acceptable were then used to treat cases in various hospitals throughout the country. The results presented are based on reports from these hospitals together with our own observations on cases in Boston. For laboratory data, the hematocrit level was stressed as

this was considered the simplest reliable measurement of cell-plasma ratio and the best index of hemodilution available under clinical conditions.

For this study the 200 cases have been classified as shown in table 1.

TABLE 1.—*Types of cases treated*

Shock following:		Hypoproteinemia	26
Trauma	25	Experimental	59
Hemorrhage	16	Miscellaneous	15
Operation	25		
Infection	9	Total	200
Burns:			
Early	18		
Late	7		

Traumatic shock cases were so classified on the basis of the clinical picture of shock following severe injury, without regard to blood pressure or degree of hemorrhage. Cases of shock from hemorrhage with relatively slight tissue damage were considered together, as these had an actual loss of fluid as well as red cells from the body. Cases going into shock at operation were segregated because it was felt these differed by the presence of anesthesia, hydration, promptness of treatment, and absence of severe trauma. There were a few cases of shock associated with severe infection.

Burns have been divided into those treated during their acute phase of plasma loss and those treated more than a week after injury, when the plasma proteins were low and edema had developed. Hypoproteinemias from all other causes have been considered together. The miscellaneous group was composed of cases unsuited for evaluation.

RESULTS

The 21 preparations released for clinical use gave almost no reactions when tested in 48 patients. Slight flushing was noted with 2 preparations on rapid injection, but no further difficulty appeared, even with large doses. Among the 141 patients treated clinically with albumin, there have been 9 fairly definite reactions. Of these, 5 were merely flushing or slight lumbar pain, while 4 were severe chills or fall in blood pressure. These occurred with the earlier preparations, no reactions having been reported from albumin processed by the method now in use.

Twenty-five cases of traumatic shock have been treated, among whom the clinical effect was interpreted as good in 17 and fair in 3. The 5 showing no change were all hopeless cases. Six others died from the severity of their injuries but showed good response to albumin for a period and would almost certainly have died with any type of therapy; indeed, several were transfused without benefit. The blood pressure recorded in 24 cases showed improvement in 19. Of the remaining 5, 3 continued to bleed, while 2 were *in extremis* at the time of treatment.

Hematocrit levels before and after treatment were obtained on 11 and showed prompt hemodilution in all except 2. These cases, although in profound shock, received less than half the usual dose.

Shock with hemorrhage was treated in 16 cases with clinical improvement in 13. This response was interpreted as marked or striking in 10. Two who were not improved had uncontrolled hemorrhage and one received less than 12 grams of albumin. The blood pressure rose above shock levels in 10 cases. Hematocrit readings done on 6 cases showed a fall in each instance varying from 5 to 50 percent.

The operative shock group consisted of 25 cases. With one exception, clinical improvement was noted in all who received more than
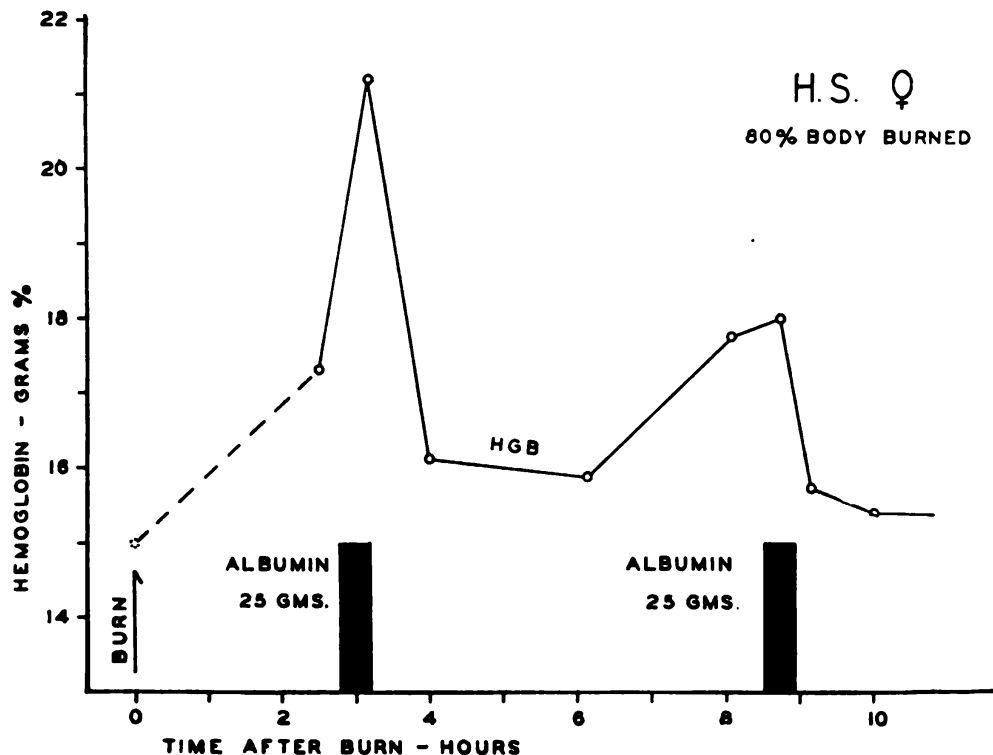
FIGURE 1.—Prompt hemodilution as shown by hemoglobin changes following concentrated albumin in a severely burned woman. This patient later died of cardiac failure.

12 grams. Hematocrit levels were suitable for interpretation in 21 cases and showed hemodilution in all but 1. Three died later because of their disease.

The 9 cases of shock associated with infection showed hemodilution in 7, but this was transient. Clinical improvement with recovery from peripheral collapse was seen in only 2. The underlying infection caused death in 7..

Acute burns involving from 15 to 80 percent of the body surface were treated in 18 patients. Three who were in circulatory collapse at the time of treatment were promptly improved, both as to peripheral

circulation and blood pressure. The hematocrit level was elevated in almost every case at the time albumin was given and was reduced in each instance. Because of continued plasma loss, the hematocrit value was found to rise again after a variable period, and repeated doses of albumin were necessary to keep it within normal limits (figure 1). This hemoconcentration recurred much more rapidly in 5 patients who received intravenous saline without protein.

Nine burn patients received concentrated albumin alone for at least 6 hours, while 3 were given the albumin chiefly as a 5 percent solution in saline. The average dose required in cases receiving concentrated albumin alone was smaller than in patients receiving dilute albumin or saline. One of the latter group, after receiving 450 grams of albumin in 60 hours, had a prolonged prothrombin time and an albumin-globulin ratio of 6.7/0.7. Both returned to normal after plasma was given.

In 7 cases of burns treated 12 days after injury, the edema resulting from hypoproteinemia improved within 24 hours with some increase in total protein. Twenty-six patients with hypoproteinemia from other causes showed hemodilution in all except one case. The changes in total serum protein were varied, however, and clinical effects were difficult to judge.

DISCUSSION

The small number of reactions, among cases tested for these alone, proves that safe preparations can be made. It is felt that these tests on selected individuals constitute a more reliable assay than can be obtained from clinical cases whose disease or injury might complicate interpretation.

Experimental work has shown that by mobilizing fluid from the tissues, albumin can increase the circulating plasma volume. Proof has been presented that this restoration of circulating volume is effective in the treatment of clinical cases of surgical shock. Administration of albumin caused prompt improvement or recovery, with rise in blood pressure above shock level in most cases. That this was due to hemodilution was shown by the consistent fall in hematocrit readings.

Whether shock followed trauma, hemorrhage, or operation, the improvement was in the great majority of instances marked and rapid. Cases which failed to respond satisfactorily were those receiving doses of less than 12 grams, which are now known to be inadequate, or those so severely injured that no treatment could help. In cases with severe hemorrhage, the loss of red blood cells did not diminish the response to albumin, but caused an anemia which was easily remedied by transfusion. The rapid rise of blood pressure following albumin adminis

tration increased concealed hemorrhage in a few cases, but this would occur with any agent which elevated the blood pressure quickly.

While hemodilution was produced in a majority of shock cases following infection, the disease remained the primary problem, and an increase of the circulating volume could achieve only temporary results.

Evidence has been presented that the hemoconcentration following burns can be decreased. As a result, secondary shock was prevented in all the cases adequately treated. Patients receiving large amounts of intravenous saline required more albumin than those given concentrated material alone. In one case in which large amounts of albumin were needed to replace the plasma loss, the globulins were significantly reduced and whole plasma was required.

In convalescent burns and other hypoproteinemias, concentrated albumin reduced edema. The accompanying hemodilution often masked, however, the increase in total circulating protein.

One unit of human albumin has been defined as 100 cc. of a 25 percent solution, which is roughly equivalent to 500 cc. of citrated plasma. This has in general been used as the initial dose in treating shock. When it did not prove effective in 15 to 30 minutes, this dose was repeated. Plasma loss as shown by frequent measurements of hemoglobin or hematocrit, determines the dose in burns. Sufficient albumin should be given to keep these readings near normal limits. Although several cases have been successfully managed for 6 hours or more with concentrated albumin alone, it would appear that over longer periods additional fluid should be supplied in the form of 5 percent albumin solution. In very severe cases in which there is continued loss of protein, albumin should be supplemented with whole plasma in order to prevent deficiency of the globulins. At the moment, 250 grams of albumin probably represents the maximum amount that should be given to any one patient.

DIRECTIONS FOR THE USE OF CONCENTRATED HUMAN ALBUMIN

One bottle (a unit) of concentrated albumin contains 25 grams in 100 cc. This is equivalent to approximately 500 cc. of citrated plasma or 2 units of dried plasma.

GENERAL INDICATIONS

1. *Severe injuries* with or without a decline in blood pressure.

2. *Shock, following trauma or hemorrhage.*—By drawing fluid into the blood stream an adequate circulating volume may be maintained or restored. Prompt hemodilution results in at least a temporary rise in blood pressure and general clinical improvement.

3. *Burns.*—Albumin may be used to replace the serum albumin lost and to reduce the hemoconcentration.

4. *Hypoproteinemias.*—Edema may be reduced and circulating proteins increased.

PRECAUTIONS

1. *Uncontrolled hemorrhage.*—As the blood pressure returns to normal following the administration of albumin, uncontrolled hemorrhage may be increased. One should then administer the albumin slowly and be prepared to ligate bleeding vessels.

2. *Marked dehydration.*—As albumin draws fluid into the blood stream at the expense of other body fluids, patients who are severely dehydrated need additional water and salt. This may be given orally if tolerated, intravenously, or by any other available route.

3. *Severe anemia.*—Albumin increases the circulating volume without adding red blood cells. If available, a whole blood transfusion should be given.

4. *Potential pulmonary edema* (Blast injuries, pulmonary irritation, etc.).— The increase in circulating volume may produce pulmonary edema.

5. *Limit of dosage.*—No more than 10 units should be given in 48 hours, as patients requiring such large amounts of protein probably need whole blood or plasma as well.

6. *Stability of solution.*—Solutions of albumin should not be used if marked turbidity or a heavy sediment is present.

DOSAGE

1. *Severe injuries and shock.*—The initial dose is one unit (25 grams) of concentrated albumin. If desired results are not obtained in 15 to 30 minutes, this dose should be repeated. Transfusions of whole blood or intravenous saline solution enhance the effect. When intravenous fluids are given, they should contain at least two units of albumin per liter.

2. *Burns.*—The initial dose is one or more units depending upon the extent of the burn. Subsequent doses should be regulated so as to prevent marked hemoconcentration and should be given in the ratio of two units of albumin per liter of saline solution.

CONCLUSIONS

1. No reactions have occurred with albumin prepared according to the method recommended for the armed forces.

2. Albumin produced prompt recovery in most cases of surgical shock.

3. Rapid and pronounced hemodilution has been shown to occur.

4. One unit of concentrated human albumin (100 cc. 25 percent solution) has been used as the initial dose in shock and repeated in 15 to 30 minutes if necessary.

5. Protein loss in burns can be replaced and the hemoconcentration prevented or corrected.

6. Directions for the use of concentrated human albumin prepared by the Committee on Clinical Evaluation of Human Albumin have been given.

_____

Part III

THE STANDARD ARMY-NAVY PACKAGE OF SERUM ALBUMIN HUMAN (CONCENTRATED)

By Commander Lloyd R. Newhouser, Medical Corps, United States Navy, and Lieutenant Eugene L. Lozner, Medical Corps, United States Naval Reserve

A preliminary description of the Standard Army-Navy Package of Serum Albumin Human (concentrated) appeared in a preceding issue

FIGURE 1.—THREE CANS OF HUMAN SERUM ALBUMIN ARE PACKAGED IN EACH BOX.
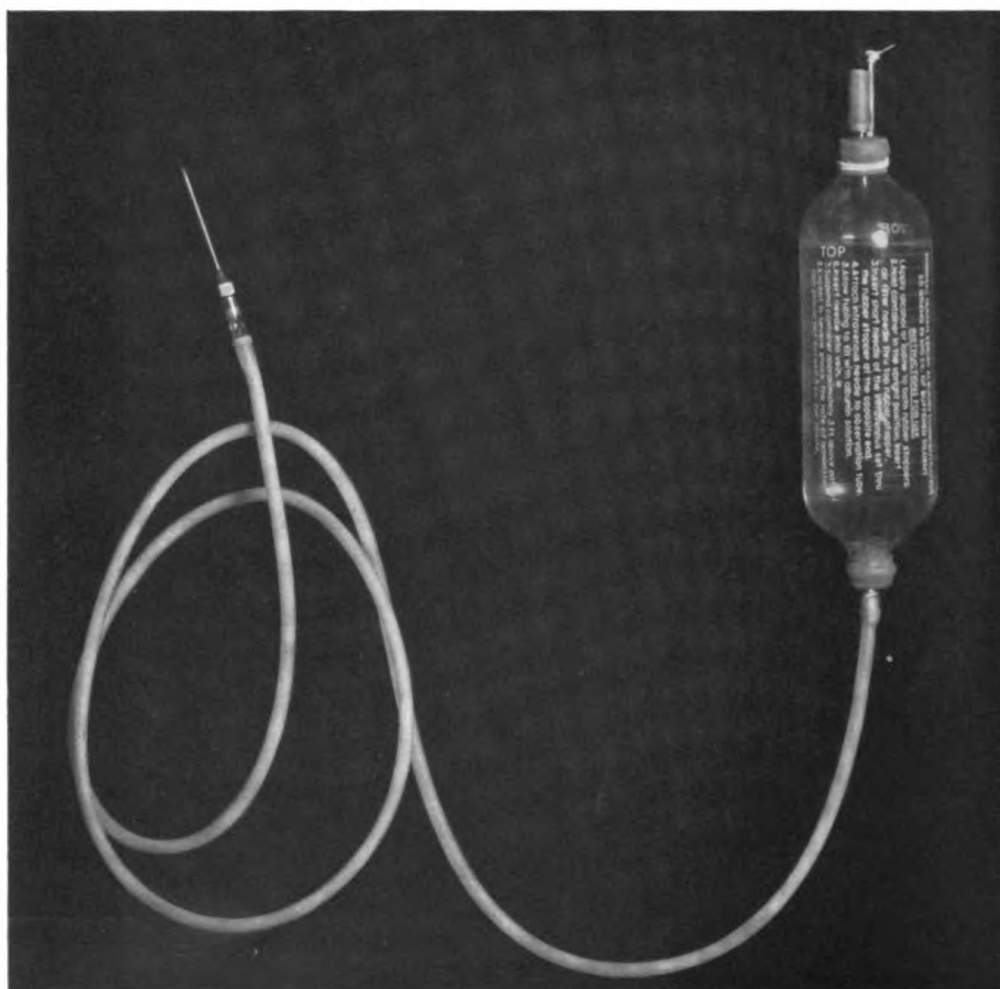
FIGURE 2.—THE HUMAN SERUM ALBUMIN PACKAGE ASSEMBLED AND READY FOR
ADMINISTRATION (SHOWING AIR FILTER IN PLACE AT TOP OF AMPOULE AND
INTRAVENOUS SET AT BOTTOM).

of this Bulletin.[1] At this time it is desired to present a more detailed description of the packaging of this therapeutic agent together with illustrations of it. The physiological and clinical experimental data concerning human albumin are presented in the two articles immediately preceding this.

A "unit" of human serum albumin has been defined as 25 grams. This is osmotically equivalent to approximately 500 cc. of citrated plasma. In the standard package, these 25 grams are dissolved in 100 cc. of buffered diluent, in which concentration it is stable for temperatures up to 50° C. The solution is contained in a double ended glass ampoule, rubber stoppered at each end. Each ampoule together with the apparatus for its administration is enclosed in a metal can. Three of these cans, containing the osmotic equivalent of 1,500 cc. of citrated plasma are packaged in a fibre board box.

In figures 1 and 2 are illustrated the various aspects of the packaging of human serum albumin.

The following instructions will be lithographed on each can:

1. Open metal can with attached key.
2. Remove air filter needle, intravenous set, and intravenous needle.
3. Remove albumin container.
4. Apply alcohol or iodine to both rubber stoppers.
5. Hold container in the upright position, insert air filter needle through top rubber stopper.
6. Insert short needle of the intravenous set through the rubber stopper at the opposite end.
7. Attach intravenous needle to observation tube.
8. Allow tubing to fill with albumin solution.
9. Insert needle into vein.[2]
10. Suspend container approximately 3 feet above patient.
11. Except in severe shock, the rate of administration should not exceed 5 cc. per minute.

Precaution.—In the presence of dehydration, albumin must be given with or followed by additional fluids.

In each package will be included directions for the clinical use of albumin and a report of the administration of each unit. The latter will be similar to the questionnaire now issued for dried and liquid plasma. It is of utmost importance that following each administration of albumin the questionnaire be filled out and sent back to the Blood Research Department, U. S. Naval Medical School, National Naval Medical Center, Bethesda, Maryland. Albumin is a new therapeutic agent and it will be only from an analysis of these reports that its worth in military medicine may be thoroughly evaluated. In order that every medical officer may be familiar with the information to be supplied on each administration a sample questionnaire follows.

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[1] Newhouser, L. R., and Lozner, E. L.: Human serum albumin (concentrated) ; clinical indications and dosage. U. S. Nav. Med. Bull. 40 : 277–279, April 1942.

[2] Venipuncture may be difficult in shock. If necessary cut down on vein.

471623—42——3

(NAME OF COMMERCIAL LABORATORY)

QUESTIONNAIRE

Data on human serum albumin (Concentrated)

I. PATIENT

Name................................. Serial No. .... Grade or rate ....
Station...
Diagnosis ....
Extent of injury ....
Disposition ....

II. INDICATIONS FOR USE OF SERUM ALBUMIN
A. Trauma with shock ☐, without shock ☐
  with hemorrhage ☐, without hemorrhage ☐
  operative ☐
B. Burns ☐
C. Hypoproteinemia ☐, apparent cause...
D. Other conditions ☐, Explain...

III. DATA ON USE OF SERUM ALBUMIN
A. Lot No. ....
B. Date given .... (Time) ....
C. Amount (expressed in gm. of albumin) ....
D. Time required for injection (minutes) ....
E. Interval between onset of symptoms and this injection of albumin ....
....
F. Blood, plasma or albumin giv   prior to this injection? ....

	Amount	*Date*	*Hour*
Blood	....	....	....
	....	....	....
	....	....	....
Plasma	....	....	....
	....	....	....
	....	....	....
Albumin	....	....	....
	....	....	....
	....	....	....
Other Fluids	....	....	....
	....	....	....
	....	....	....

IV. RESULTS
A. Beneficial: Yes ☐, No ☐
B. Unfavorable reaction: Yes ☐, No ☐
 1. Mild ☐, moderate ☐
  (a) Urticaria: Localized ☐, generalized ☐, interval before onset ....
  (b) Chills and fever: Yes ☐, No ☐, interval before onset ....
 2. Severe ☐ (If reaction is severe, fill in Questionnaire on reverse side of sheet.)
C. Blood pressure and pulse:
 1. Prior to injection: BP   /   , Pulse ....
 2. Thirty minutes after injection: BP   /   , Pulse ....

QUESTIONNAIRE (continued)

V. COMMENTS

Including opinion as to adaptability of the product and equipment used in administration for field use_____

_____

_____

The information requested on this form is essential for determining the methods of preparation best suited to the needs of the Armed Forces.

Signature_____, Rank_____

IV-B2. DETAILED REPORT OF SEVERE REACTIONS

A. Onset _____ hours after albumin infusion started.

B. _____ hours duration.

C. Manifestations :

Urticaria :   Localized ☐ , generalized ☐ ,

immediate ☐ , delayed   ☐

Chills ☐

Apprehension   ☐

Fever ☐ , (Record greatest elevation of temperature) _____

Substernal oppression ☐

Throat constriction   ☐

Abdominal pain   ☐

Muscular pain   ☐

Pallor   ☐

Flushing   ☐

Miscellaneous   ☐

_____

_____

_____

D. History of allergy.   Yes ☐ , No ☐

What substances_____

_____

_____

_____

Fill in and return to : Blood Research Division,
Army Medical Center,
Washington, D. C., or Blood Research Division,
National Naval Medical Center, Bethesda, Md.

Plasma and Other Fluids: Fluid replacement therapy is actually the most important element in the treatment of burn shock. Plasma is lost in large amounts, and large amounts of plasma should be replaced. Whole blood is useful when plasma is not available, but its contained erythrocytes are superfluous. All burned patients should be kept in adequate chloride balance, but usually 1,000 cc. of isotonic solution of sodium chloride a day (10 gm. of sodium chloride) is sufficient unless the patient is vomiting or otherwise losing chlorides in abnormal amounts. Dextrose should be given in large amounts to protect the liver, but its administration should be by mouth whenever possible. Complete reliance on crystalloid solutions for intravenous fluid replacement therapy for burn shock is fallacious. Plasma, then, is the best means of replacing the fluid loss due to thermal trauma.—The Treatment of Burns in Wartime, Henry N. Harkins, M. D. ; J. A. M. A. 119 : 386, May 30, 1942.

SIMPLIFIED AND ECONOMICAL PLASMA BANK TECHNIC [1]

By Captain M. D. Willcutts, Medical Corps, United States Navy; Lieutenant R. A. Hicks, Medical Corps, United States Naval Reserve; and Lieutenant, junior grade, A. H. Robnett, United States Navy

The therapeutic employment of pooled human plasma in this hospital has abundantly confirmed the known, essential, lifesaving character of this substance in the treatment of shock and related conditions. The establishment of a plasma bank at the United States Naval Hospital, San Diego, Calif., on December 10, 1941, was undertaken as a war measure. The problem of war time communications was taken into consideration. Multiple sources of plasma, in addition to larger, centralized foci of plasma production, may have special military significance.

The simplest technic has been employed. This bank has operated for the first 9 months without incident or loss and without serious, unfavorable reaction in patients treated. In the administration of the first 200 units of plasma, two patients developed transitory urticaria, readily controlled by adrenalin and morphine. Ten thousand units (250 cc. each), of plasma, and over 1,000 whole blood transfusions have been processed. Recently the plasma production has been increased to 900 units per week.

It is not our purpose in this comment to review the bulk of over 150 basic reports on the subject of plasma banks, nor do we wish to recapitulate the minutiae of technical detail which have been so well and so often delineated elsewhere. The speed of handling donors, the economy of operation, and the character of the solution used in the blood preservation are the distinguishing features of the bank at this hospital.

All donors used are from naval units in the San Diego area. These men constitute an ideal source of blood. The process stimulates their morale and assists them to appreciate the provision that is being made for their own possible future care. The men are lined up early in the morning and the blood collection is accomplished with an absolute minimum of physical and psychic trauma.

The room where venesection is done is arranged with six tables. Each table is tilted downward toward the donor's head. One supply table stands at the end between each two bleeding tables and there is one operator to each two tables (fig. 1). Care is taken to make a sliding, valvelike venipuncture so that the hole in the skin after the removal of the needle is never continuous with the hole in the vein. As the bleeding is finished the next donor is stationed at the foot of the table and immediately replaces the donor preceding him. An arm dressing, general care, and breakfast are provided to the men at once

FIGURE 1.—BLOOD COLLECTION: SHOWING ROOM ARRANGEMENT, PERSONNEL, AND DONORS.

FIGURE 2.—BLOOD COLLECTION. CLOSE-UP OF OPERATOR, ASSISTANT, DONOR, AND APPARATUS.

upon leaving the bleeding room.   Using this procedure, with a staff
of eight hospital corpsmen, two nurses, and one doctor, it is routine
to bleed donors at the rate of one per minute.

COLLECTION

Apparatus.—Fourteen-gage needles with 12 inches of 6 mm., pyro-
gen-free tubing directly attached.   Glass adapters are not desirable.
Sterilize in bundles of five.   Hexagonal, small mouth, 8-ounce, pyrex
nursing bottles are used as collection containers.   Clean in the stand-
ard way to eliminate pyrogenic substances.   Dry-heat sterilize with
skirt-covered, cotton-gauze plugs.   Aseptically pipette 25 cc. of the
"basic solution" into each bottle.

Basic Solution.—This solution, when mixed in parts of 1 to 9 with
blood, will give a plasma in which the final dilution of the reagents is
approximately as follows:

Sodium Merthiolate	1/10,000
Sodium Citrate	0.5 percent
Sodium Sulfathiazole	0.2 percent

In making up this solution allowance has been made for two factors:

1. The reagents are present in slight excess so that if as much as a
total of 600 cc. to 650 cc. of whole blood were to be added to a total of
50 cc. of the solution provision is still made for the preservation and
anticoagulation action desired.

2. It is possible that phenomena of adsorption by platelets, leukocytes
and erythrocytes might decrease the amount of the reagents in the
plasma after the sedimentation of the formed elements.   The slight
excess of reagents makes it possible to discount this contingency.   The
solution is made up in bulk and sterilized by filtration.

	cc.
Pyrogen-free physiological saline	2, 000

	gm.
Sodium Citrate	90
Sodium Merthiolate	2
Sodium Sulfathiazole	50

Bleeding.—Prepare donor and collect blood by open method, using
restricted field technic (fig. 2).   Set sphygmomanometer at about 80
millimeters.   Vacuum not required.   Collect key Kahn specimen after
bulk is obtained.

STORAGE

Room temperature for 5 days.   Observe sedimentation daily and
inspect for hemolysis.   Aspirate plasma and pool in containers of at
least 200 cc. each.   Freeze, allowing for 2 percent expansion.

In the beginning of this work great numbers of sterility tests, aerobic and anaerobic, were conducted according to the regulations of the National Institute of Health. Contamination was not detected and, accordingly, it is now routine to freeze plasma immediately after pooling and to do no sterility testing until the plasma is withdrawn from the refrigerator and thawed for use. Under present conditions, plasma needs are anticipated and care is taken to allow at least a 7-day interval between the beginning of the sterility tests and the first therapeutic use of the plasma tested. During this interim the plasma is kept in the refrigerator at 7° C. Pyrogen and pH determinations on reagents and plasma are desirable from time to time.

For whole blood bank, place suitable specimens of whole blood aside in ice box immediately after drawing.

ADMINISTRATION

Thaw and divide in unit containers for administration with both fine and coarse filters in line. Do not administer without a filter. The filters employed in this hospital are of two types. The coarse filter is a bakelite cylinder, 9 by 58 mm., arranged to project into the plasma container from a screw-in base in the two-way bakelite bottle top. This filter has six 1 mm. longitudinal slots. It adequately removes fibrin veil and any large particles in the plasma. In the infusion tubing, above the visual drip, a bakelite container is arranged so that it stretches a 50-mm. perforated, rubber disk across the flow of plasma. The holes in the disk are approximately 74 μ in diameter. This disk can be cleaned and reused many times, but is designed to be an expendable unit. The plasma flows freely and the filter system described does not become obstructed.

SUMMARY

A basic solution is described for use in the processing of human plasma. Plasma prepared with the assistance of this solution has remained sterile, is nontoxic and is convenient in administration. The work in this plasma bank confirms the findings of Novak[1]:

1. That chemical incompatabilities do not exist between sodium merthiolate and sodium sulfathiazole when both are used together in a preservative solution.

2. "Elaborate and expensive methods for routine processing of plasma are unnecessary in most hospitals."

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[1] Novak, M.: The use of sulfonamide derivatives as a solution to the problem of bacterial contamination in stored plasma, J. A. M. A. 118: 513–515, Feb. 14, 1942.

ANESTHESIA [1][2]

By Captain Joseph J. A. McMullin, Medical Corps, United States Navy, and Lieutenant, junior grade, Joseph P Thornton, Medical Corps, United States Naval Reserve

During the first World War, ether, chloroform, regional anesthesia (ethyl chloride), nitrous oxide plus ether anesthesia were used extensively with considerable success. Operations for chest injuries were performed by local infiltration and nitrous oxide anesthesia. For abdominal surgery a combination of nitrous oxide and ether anesthesia was practically routine.

Toward the end of the war the popularity of spinal anesthesia increased. Previously, surgeons were hesitant to use spinal anesthesia. This prejudice was engendered by the number of fatalities following the use of cocaine, and later of stovaine and spinocaine (1).

Improved preoperative treatment, the use of fluids to counteract dehydration and shock, the use of sedatives for the prevention of psychic reactions, and the employment of ephedrine to prevent or remedy a fall in blood pressure, were factors which helped to popularize spinal anesthesia.

It was recognized about this time that when a large amount of blood had been lost the blood pressure and pulse were not always good criteria for determining the patient's condition. Many patients with approximately normal blood pressure reading and pulse rate collapsed a few hours later due to a relative depletion of hemoglobin and a diminution of the oxygen-carrying power of the red blood cells.

Since the war, anesthesia has progressed considerably. Better methods of administration, greater care in the selection of the type of anesthesia, better anesthetic agents, but most important of all, better trained anesthetists, are responsible for this progress. Some of the new drugs include: cyclopropane, ethylene, divinyl ether; intravenous anesthetics, such as epival and pentothal sodium; spinal intrathecal drugs, including novocaine, pontocaine, nupercaine and metycaine; and in rectal anesthesia, avertin. The selection of the proper anesthetic is quite as important as its proper administration.

The best anesthetic in any given case is the one which will cause least harm to the patient, and yet be adequate for the performance of the anticipated operation. Anesthetic agents are now frequently used in combination when both together accomplish definite results neither of which alone could produce. The men of the Navy are carefully selected and, generally speaking, are better than average risks, but some of our patients are veterans of the first World War, and many of them are poor risks.

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[1] Received for publication April 8, 1942.
[2] Delivered at the annual meeting of the Clinical Congress of the American College of Surgeons and the International Anesthesia Research Society at Boston, November 5, 1941.

Various changes in methods include:

1. The closed system of inhalation anesthesia with utilization of the soda lime absorption technic.

2. Intratracheal anesthesia.

3. Intravenous methods including sodium amytal, morphia, evipal, and pentothal sodium.

4. Continuous spinal anesthesia and the use of hyperbaric solutions with glucose to give anesthesia definite levels.

5. Sacral and caudal anesthesia.

6. Other regional anesthesia technics, such as cervical block, brachial plexus block, transsacral block, paravertebral block, intercostal and peridural block. These will be considered in conjunction with the drugs best suited for their purpose.

Ether, the safest of the volatile anesthetic agents, is used considerably in the Navy in times of peace. However, it is inflammable and explosive, rather irritating to the respiratory tract, and it may produce deleterious changes in the function of the blood and tissues. For operations below the diaphragm, ether, with few exceptions, has been replaced by spinal. For short operations, and for those operations not requiring relaxation, intravenous anesthesia has also partially replaced ether.

The risk of explosion has been greatly reduced by the closed method of administration and the use of the intercoupler for preventing static sparks. In the closed system, with the carbon dioxide absorption technic, ether is first preceded by an induction of nitrous oxide (or cyclopropane) and oxygen. A definite amount of these gases is regulated by a fine gage and is mixed and passed to the breathing bag. From the bag the mixture is inspired into the patient's lungs. The expired gases pass from the lungs through a chamber containing soda lime where the carbon dioxide is removed from the mixture. From this point the gases pass to a rebreathing bag where they pass back to the patient's lungs on inspiration. This method reduces fire hazards and also the waste of gases, and keeps the surrounding room almost free from the anesthetic, the gases being breathed over and over again.

When nitrous oxide is administered, this method is used to induce anesthesia and usually is followed by ether to obtain adequate relaxation. In itself N_2O has the advantage of being nonexplosive and nonirritating to the lungs, but it is inadequate for major surgical operations requiring relaxation.

Cyclopropane is a powerful inhalant anesthetic. It is nonirritating to the lungs and less injurious to the blood and tissues than the other volatile drugs. However, it is highly explosive in anesthetic doses. Cyclopropane has proven valuable in the hands of experienced anesthetists. It is considered useful when the vital capacity is diminished, and the oxygen carrying power of the blood is decreased. It is usually the anesthesia of choice in chest surgery. In the Navy, because of its inflammable and explosive characteristics, it is little used.

Divinyl ether is used in Chelsea for surgical procedures of short duration which require little muscular relaxation. It is also used to induce ether anesthesia or to complement less potent gases such as nitrous oxide. There is evidence from recent literature that this anesthetic, like ethyl ether, may cause convulsions and liver damage (2). This evidence is conflicting, but it should not be used if there is evidence of renal or hepatic insufficiency. It is safer and better than ethyl chloride, and is a useful adjunct to our armamentarium.

The three volatile agents mentioned—ether, cyclopropane and nitrous oxide—are more efficiently administered by the ordinary closed method. This does not suffice in all cases. The intratracheal method, by either nasal or oral route is indicated in major chest surgery (3). Blind intubation with the Magill tube may be sufficient, but it is safer to visualize the vocal cords with a laryngoscope while inserting the tube in the trachea. Positive pressure can be measured and maintained continually. Bronchial secretions and other obstructions to the air passages can be removed easily and quickly, and oxygen can be supplied immediately.

Intratracheal anesthesia is also used in operations of the upper abdomen when relaxation and quiet respiration are required. It is also used in operations upon the posterior surface of the chest or abdomen when the position of the head causes obstruction of the respiratory passages. Intratracheal anesthesia is also used in intracranial surgery. The blood pressure is not increased when the air passages are kept freely open (4).

Intravenous anesthesia has made giant strides since its introduction and it is used extensively in naval hospitals. It is employed:

1. For the induction of general anesthesia and to reduce psychic trauma.
2. To supplement spinal anesthesia.
3. To relieve nausea and retching during the course of spinal anesthesia.
4. For short operations not requiring muscular relaxation if there is no interference with respiration.
5. In poor risks when operation is necessary and regional block is indicated. Pentothal in these cases will allay the pain sustained in carrying out the block and by its central action aid in relaxation and the prevention of shock (9).

The two drugs most frequently used in intravenous anesthesia are pentothal sodium and evipal soluble, the latter being restricted to cases where liver damage is present and includes those cases treated with the sulfonamide group of drugs. As a safety precaution, when an intravenous anesthetic is used an airway is placed in the patient's throat, and oxygen is administered throughout the operation. One of the advantages of intravenous anesthesia is the practicability of its use with minimum personnel and equipment. Aboard ship, however, the method of choice for operations below the diaphragm is spinal anesthesia.

REGIONAL ANESTHESIA

Spinal anesthesia is the most useful and the most popular type of regional anesthesia. The simplicity of administration, resulting in the production of excellent muscular relaxation, the small dosage of drugs necessary to effect anesthesia, and the quick and comfortable recovery account for its popularity (6). Without preliminary medication this method may be distressing to a nervous patient. It is our policy to use a barbiturate the night before operation, and again in the morning 2 hours before operation. This is followed by morphine or pantopon and atropine or scopolamine depending upon the individual indication. This premedication often controls toxic reactions of the anesthetic agents. Spinal anesthesia is never induced without an oxygen machine in the room, and the availability of a supplementary anesthetic agent which can be utilized if the effects wear off before the completion of the operation. In the last few years pentothal sodium, as a supplementary agent, has been the drug of choice. Pentothal sodium is rapid in action, is easily administered and is effective in controlling the patient under these circumstances (5).

With the improved types of anesthetic agents, increased knowledge of spinal fluid dynamics, and improved technic in administration the contraindications to spinal anesthesia have decreased (6). Shock is a contraindication to spinal anesthesia, but when the blood pressure and other symptoms have improved sufficiently with appropriate treatment spinal anesthesia may be used. For the past few years it has been realized that pain is an important factor in surgical shock. For this reason, when local anesthesia is not effective or fully effective the possibility of collapse may be greater than in a spinally anesthetized patient free from pain. When pain occurs in the course of spinal anesthesia, supplementary intravenous anesthesia should be administered. The administration of the spinal anesthetic is the smallest part of the anesthetist's task. Oxygen correctly and adequately administered has lessened the danger of spinal anesthesia. Respiratory paralysis is the most frequent cause of death. If artificial respiration is carried on rhythmically by attaching the end of the intratracheal tube to the face piece of the modern anesthesia machine many spinal anesthesia fatalities will be prevented. This procedure forms a closer circuit and by manual manipulation of the bag, artificial respiration with oxygen coming from the tank may be efficiently carried out.

CARE OF PATIENTS UNDER SPINAL ANESTHESIA

Complications usually develop during the first half hour of spinal anesthesia. A minor complication in one individual may be a major

complication in another. When in doubt it is better to over treat in apparent minor complication than to under treat a questionable major complication. Falling blood pressure is of considerable significance in patients under spinal anesthesia, but the patient's general condition is even more significant.

The danger signs and symptoms are:

1. The occurrence of pallor.
2. Cold perspiration.
3. Diminished pulse volume and pulse pressure.
4. Rapid pulse.
5. Decreased or shallow respiration.
6. Transient or progressive confusion, or dulling of the intellect.
7. Nausea and vomiting.

Of these occurrences, much consideration should be given to vomiting and alterations of respiration.

It is well known that vomiting frequently occurs with procedures requiring traction on the gallbladder, liver, stomach, or spleen, but it is not so well known that this vomiting is often associated with a sudden fall in the blood pressure. When this type of vomiting persists and cannot be stopped by oxygen administration, cold compresses and the administration of pressor drugs, then intravenous pentothal sodium should be given. In such instances intravenous pentothal sodium will terminate the vomiting and allow the blood pressure to return to a safe level. Decreased respiration is so important that a lack of vigilance in noting the beginning of intercostal paralysis may result in a fatality, especially if intercostal paralysis is followed by diaphragmatic paralysis. To insure sufficient oxygenation during spinal anesthesia, it is a routine procedure for the anesthetist to administer oxygen during operations involving procedures in the upper abdomen. When high-level spinal anesthesia is used, especially for poor risks with diminished vital capacity, O_2 should be administered. When medullary failure of respiration impends, additional utilization of pressure drugs and the Trendelenburg position are required to oppose and curtail the falling blood pressure. Blood or plasma transfusions should be given in those cases which do not respond quickly to other forms of treatment.

For routine fall in blood pressure the usual procedure is to place the patient in the Trendelenburg position, administer O_2 and inject subcutaneously or intramuscularly 5 units of pitressin or 25 mg. of ephedrine (or as an alternative 1 to 3 mg. neosynephrin); 1,500 cc. of 5 percent glucose in normal saline should be administered intravenously. In those cases blood or plasma transfusion may be indicated.

The drugs most commonly used in spinal anesthesia are in order of their popularity:

1. Procaine
2. Pontocaine
3. Metycaine.

Nupercaine has been used for lengthy operations, but it is being substituted by the utilization of continuous anesthesia using novocaine or pontocaine.   The variability of results obtained, even when the same technic and the same drug are used, may be explained by the variability of spinal fluid specific gravity, which may vary from 1.002 to 1.008.   Solutions of some agents which usually are hyperbaric (heavier than spinal fluid) may, because of this variability of specific gravity of spinal fluid, in any given patient, be isobaric or even hypobaric.   Hence there is a trend toward the utilization of those drugs which, when injected, will follow a predicted course.   For this reason a mixture of pontocaine solution (1 percent) and 10 percent dextrose solution has increased in popularity.

Procaine with low toxicity and a wide margin of safety continues to be the most popular anesthetic agent in the Navy.   It is the favorite both in local and spinal anesthesia.   It is highly efficient and its stability, freedom from irritation of the tissues, and harmlessness to circulation and respiration justify its popularity.

Pontocaine, made heavy by mixture with 10 percent glucose, has been a step forward in anesthesia because of the ability to control the level of anesthesia.   There is a difference of opinion regarding the advantages and disadvantages of pontocaine compared with procaine.   The adherents of pontocaine say it is almost 10 times as potent as procaine, less depressing to the blood pressure, that it causes less nausea and vomiting, and carries few postoperative complications.   The dosage varies between 8 to 20 mg. of a 1 percent solution in 1 to 3 cc. of 10 percent glucose, depending upon the physique, age, operation and operator.   The position of the patient at the time of injection depends on whether the lower abdomen or upper abdomen is to be operated upon. This drug (pontocaine) is an excellent one for operations of the upper abdomen, such as gallbladder, stomach, and kidney operations where 1½ hours or more are necessary.   It also is an excellent anesthetic for operations in the lower abdomen.   Pontocaine in glucose anesthesia may be limited to the lower abdomen by tipping the table.

Pontocaine and glucose spinal anesthesia has been utilized in obstetrics in our dependents' ward.   It has been shown that neither bearing-down pains nor uterine contractions force the drug up the spinal column to the medulla.   It has been used successfully in 80 deliveries and is favored because of lessened postpartum vomiting and ileus, minimal bleeding, good preservation of uterine tone, cooperation of the patient,

and less danger to the baby. Although caudal anesthesia has been recommended, we have not found it so satisfactory as low spinal anesthesia. Five mg. of pontocaine crystals are dissolved in 2 cc. of 10 percent glucose. The injection is made in the third lumbar space with the patient leaning forward in the sitting position. The anesthesia lasts from 1 to 1½ hours, and is induced when the cervix is fully dilated.

Continuous spinal anesthesia.—The continuous spinal anesthesia method devised by Lemmon, in the Jefferson Hospital, utilizes a german silver needle which remains in *situ* during the operation. This is possible by the use of a special mattress and a malleable needle, which adapts itself to changes in the spinal curvature, and is large enough to exert friction necessary to keep it in place when the patient's position is changed. A connecting rubber tube attaches to the end of the needle, and is carried to the anesthetist's table.

As much as 900 mg. of novocaine (10 percent) solution have been used successfully in operations lasting 4½ hours or longer.

Rectal anesthesia.—This form of anesthesia has been used for selected cases, but always as a basal anesthetic. It is used in extremely nervous patients whose physical condition warrants it. We have used it as a preliminary in conjunction with local anesthesia for the removal of toxic goiters.

Local anesthesia is popular with naval surgeons. The full extent of the advantages of this type of anesthesia can be appreciated when one reads the report of Dr. Adam of Budapest of 23,797 major operations performed under local anesthesia without a single fatality during operation.

Local anesthesia calls for gentleness, patience, and exacting anatomical knowledge, as well as appreciation of amounts of the anesthetic drug tolerated, its toxicity, its variation of dosage with the part involved, and the choice of methods.

The methods most commonly used are: (1) Nerve block; (2) Anesthesia of abdominal cavity, using either solar plexus or hypogastric plexus block, with infiltration of the mesenteric attachments or paravertebral block.

It is of importance to realize that local anesthesia requires special training. In the hands of an expert we consider local anesthesia, by and large, the safest of all methods. Its use would be vastly more extensive if surgeons had sufficient forbearance and skill to use it.

The local anesthetic drugs used by us in order of their popularity are: (1) Procaine, ½ of 1 percent to 2 percent; (2) pontocaine, 0.1 percent solution; (3) metycaine, 10 percent.

Anesthesia in the Chelsea Naval Hospital is under the supervision of trained anesthetists who are medical officers, who examine their patients before operation, select the type of anesthetic best suited for

each patient, administer the anesthetic, and remain responsible for the patient until he recovers from the anesthetic. This policy, we are pleased to say, has eliminated anesthetic deaths during the past year and has lowered our surgical mortality.

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CORONARY INSUFFICIENCY AND CORONARY OCCLUSION [1].

By Commander Arthur M. Master, Medical Corps, United States Naval Reserve; Lieutenant Commander H. H. Carroll, Medical Corps, United States Navy; and Lieutenant Commander Cecil Andrews, Medical Corps, United States Navy

Disease of the coronary arteries is the most common form of heart disease; hundreds of thousands of attacks of coronary occlusion alone occur yearly in this country (1). Coronary disease is apparently on the increase, and this increase is influenced by several factors. One of these is that this disease is more common in those over 40 years of age, and, due to man's partial victories over his greatest enemies of former decades, the childhood diseases, tuberculosis, pneumonia, typhoid, typhus, etc., an increasingly greater percentage of the population is living to attain the higher age brackets. Added to this is the fact that the medical profession is not only becoming "coronary disease conscious," but the recent advances in electrocardiography and roentgenoscopy have made the diagnosis of coronary heart disease an easier and more accurate procedure.

Although the bulk of naval personnel falls in the younger age groups, coronary heart disease is an important factor in the Service. This is particularly true among the officer personnel, of whom 39 percent are

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over 40 years of age (2). The 15 cases reported in this article were all observed on the Medical Service of the United States Naval Hospital, Washington, D. C., within a period of 5 weeks. All but two were bed patients actually in the hospital during that time, and these two were returning for observation and treatment.

The term "coronary insufficiency" has long been established as a definite entity in the foreign literature (3) (4) (5) (6), but it is only in recent years that the term has been used in this country (7) (8) (9) (10) (11). There is still confusion about its meaning, and there is confusion as to the various forms of coronary heart disease (12) which range from simple attacks of angina pectoris on the one hand to cases of complete arterial occlusion with definite myocardial infarction on the other. A considerable portion of the cases of coronary heart disease fall between these two extremes, and it is the purpose of this paper to attempt to clarify this middle zone—chiefly to aid in their recognition and also to establish criteria for more accurate prognostication regarding their final disability and disposition.

The subjects of this paper are coronary insufficiency and coronary occlusion. The former is a necrosis or infarction of the myocardium without occlusion of the coronary arteries; the latter is, by definition, a 100 percent block of one or more branches of a coronary artery. We use the terms coronary occlusion and thrombosis synonymously, but prefer the term occlusion as in many cases at autopsy no thrombosis is found or, if present, is secondary to an intimal hemorrhage (13) (14) (15) (16) (17) (18) (19) (20) (21). Coronary insufficiency and coronary occlusion are really different diseases and usually can be distinguished one from the other. They differ in exciting cause, in severity, in the time of necessary treatment, and especially in their prognosis, so that their recognition is of vital importance to all physicians, civil as well as military. Coronary insufficiency may be brought on by either mental or physical strain, whereas coronary occlusion (21) (22) (23) occurs irrespective of what the patient happens to be doing at the time. Acute coronary insufficiency may be so slight that a prolonged period of treatment or invaliding from the service will not be necessary, whereas the other nearly always necessitates both of these measures. In fact, a patient may completely recover from an attack of acute coronary insufficiency in a few days, whereas in coronary occlusion the patient requires 4 to 6 weeks of bed rest, followed by a prolonged convalescence, and objective evidence of severe heart disease, even in a case that is doing well, will usually remain for from 1 to 2 years. These differences between the two make it essential to distinguish between them. While it will always be necessary to invalid from the service practically all the cases of coronary occlusion, it may be possible to retain many cases of coronary insufficiency on active duty, if not at sea then on shore duty. This would be especially valuable in case of national emergency such as

the present when all available hands are needed in some capacity or other. Previously most cases of coronary insufficiency would have been indiscriminately labeled coronary thrombosis.

In this 250 bed general hospital with medical, surgical, eye, ear, nose and throat, genito-urinary, and neuropsychiatric departments treating active and retired naval personnel, but no veterans' administration patients, there were 15 patients in 1 month suffering from heart attacks necessitating hospitalization and which could be definitely diagnosed one or the other of the 2 entities under discussion, i. e., coronary insufficiency or coronary occlusion (tables I and II).

Before entering into a description of the tables we shall present three illustrative cases, two of coronary insufficiency and one of coronary occlusion.

CASE REPORTS

Case 5.—H. A. K., a man of 54 suffered an attack of acute coronary insufficiency brought on by strenuous mental and physical work. On the day of admission, November 14, 1941, the electrocardiogram (fig. 1A) revealed depression of the RS–T segment in leads I and II, with semi-inversion of the T-waves in these leads. The next day the electrocardiogram had returned to normal, i. e. there were no longer RS–T segment or T-wave abnormalities in the first two leads. The electrocardiogram after the standard "2 step" test (24) was positive, i. e. the electrocardiographic changes were abnormal and presented a very similar picture to that seen in his attack (fig. 1B). The changes were perhaps a little more marked for RS–T segment depression, and T wave changes were present in lead IV as well as in I and II. The return of the electrocardiagram to normal following the changes noted after the "2 step" test was prompt, but the fact that they occurred must be considered abnormal and confirmatory of the diagnosis of acute coronary insufficiency as they are not seen in normal adults (24).

Another patient with acute coronary insufficiency was case 7.

L. S., age 51. An attack of pain occurred following a 2-day attack of acute enteritis, during the last 20 hours of which paroxysmal tachycardia with a rate of 180 beats per minute was present. When the heart rate had just begun to slow down the patient took his daily gymnastic exercise on a "Gene Tunney"[1] apparatus and during this exercise developed the attack of substernal pain for which he was sent to the hospital on November 19, 1941. The electrocardiogram (fig. 2A) revealed left axis deviation, a widened QRS complex, an isoelectric (flat) T_1, T_2 which was slightly inverted, and definite inversion of T_4. By November 22, 1941 the T waves in these 3 leads had returned to normal.

On February 27, 1942, at a follow-up visit, the electrocardiagram (fig. 2B) after the "2 step" was positive, that is a low amplitude T_1 became slightly inverted and T_4 became definitely inverted. These changes were not so marked as in the electrocardiogram of November 19, 1941, but the clinical condition of the patient had improved considerably in this interval. Among other features of this improvement was a loss of 20 pounds in weight effected by dietary restriction.

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[1] This is no criticism of the exercise, but merely emphasizes the danger of excessive physical exertion in patients with coronary artery disease.

PLATE 5
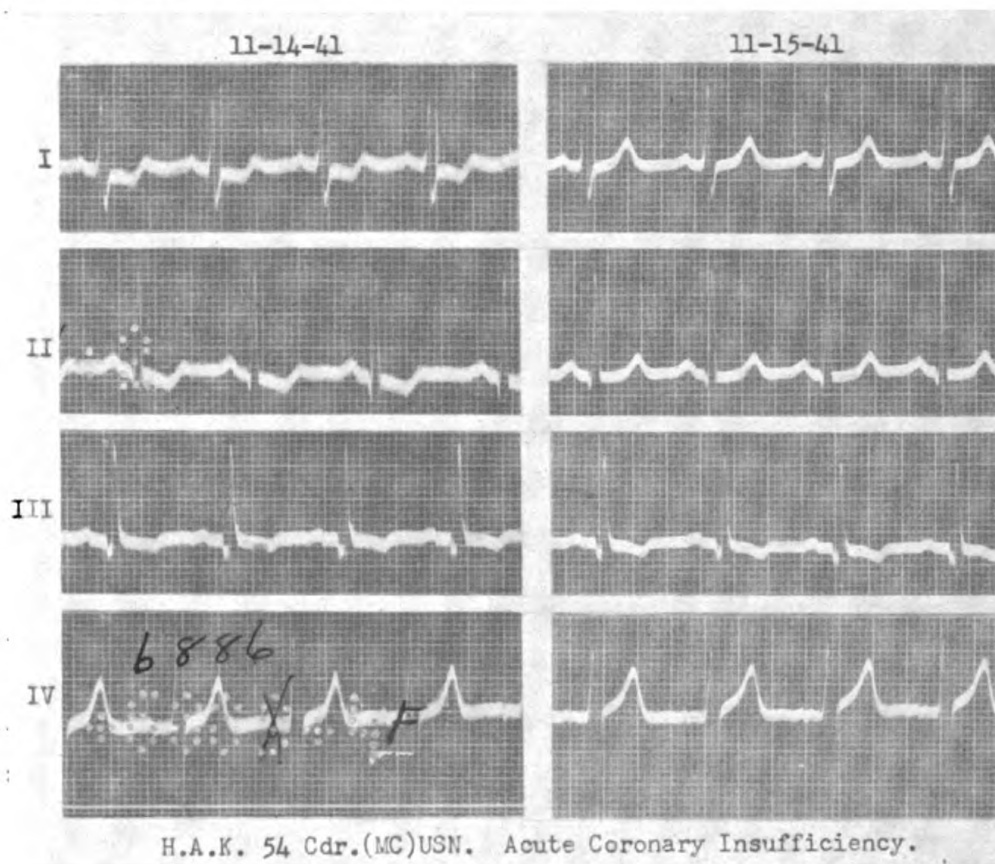
FIGURE 1A.—H. A. K. (60138), MALE, 54. CORONARY HEART DISEASE, ACUTE CORO-
NARY INSUFFICIENCY. ON DAY OF ADMISSION TO HOSPITAL 11/14/41 THE ELEC-
TROCARDIOGRAM REVEALED DEPRESSION RS-T SEGMENT IN LEADS I AND II
WITH SEMI-INVERSION OF THE T-WAVES IN THESE LEADS. THE TRACING HAD
RETURNED TO NORMAL ON 11/15/41.

ECG. AFTER MASTER " 2-STEP TEST " 19 TRIPS

Control   Immed.   3 min.   8 min.

I

II

III

IV

H.A.K. Cdr,(MC), U.S.N. Ac. Cor. Ins., Cor. Heart Disease. 1/15/42 54 yr.
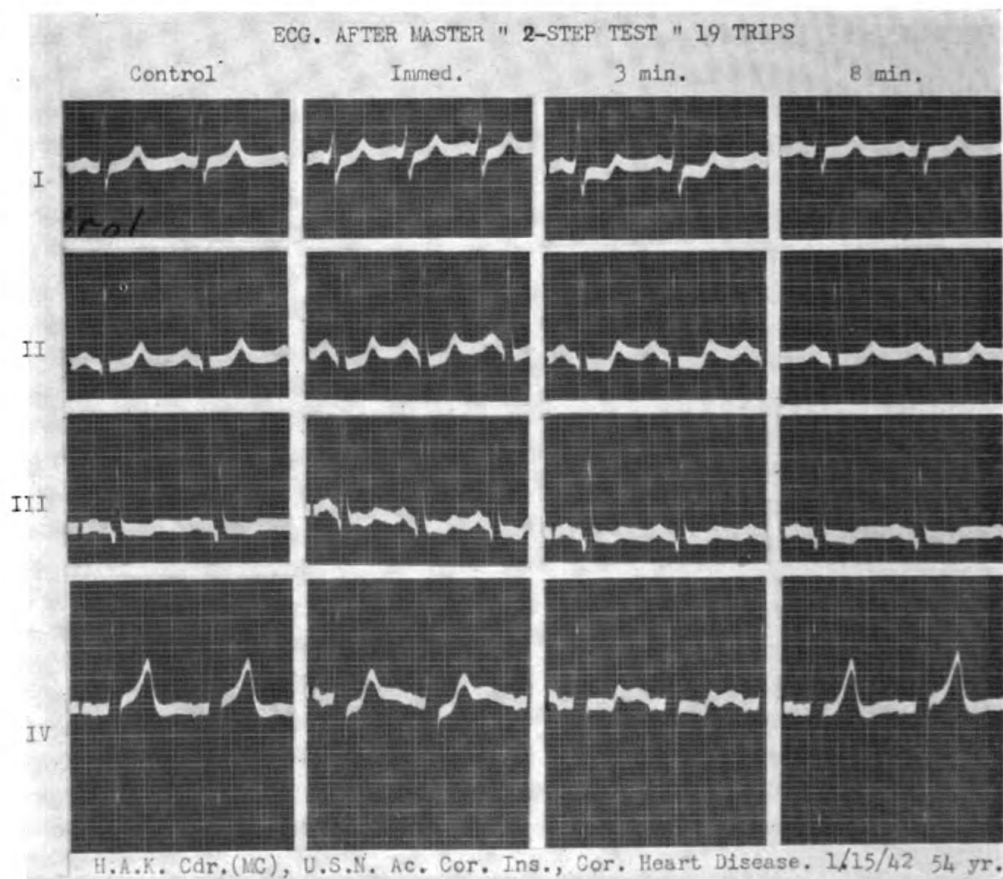
FIGURE 1B.—H. A. K., SAME PATIENT. RESULTS OF "2 STEP" TEST. CONTROL ELECTROCARDIOGRAM NORMAL BUT AFTER STANDARD "2 STEP" EXERCISE RS-T_{1-2-1} BECAME DEPRESSED AND T_{1-2-1} SEMI-INVERTED, THUS CONFIRMING DIAGNOSIS OF ACUTE CORONARY INSUFFICIENCY. EIGHT MINUTES AFTER EXERCISE THE ELECTROCARDIOGRAM HAD RETURNED TO NORMAL.
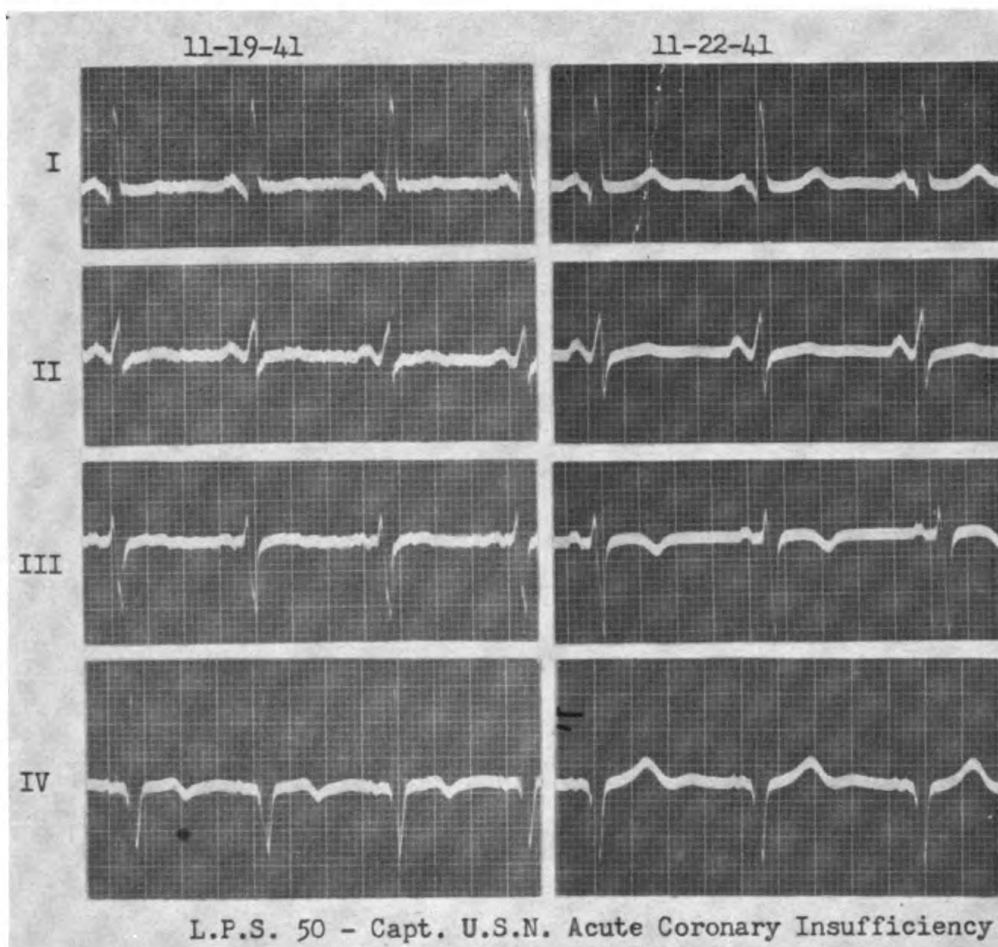
FIGURE 2A.—L. S. (60168), MALE, 51.   HYPERTENSION, CORONARY HEART DISEASE.
ACUTE CORONARY INSUFFICIENCY.   ON DAY OF ADMISSION TO HOSPITAL 11/19/41
THE ELECTROCARDIOGRAM REVEALED A WIDE QRS GROUP, A FLAT T_1, SMALL
ALMOST INVERTED T_2 AND DEFINITELY INVERTED T_4.   ON 11/22/41 THE TRACING
HAD RETURNED TO NORMAL.

ECG. After MASTER "2-Step" 19 Trips.

Control   Immed.   3 min.   8 min.
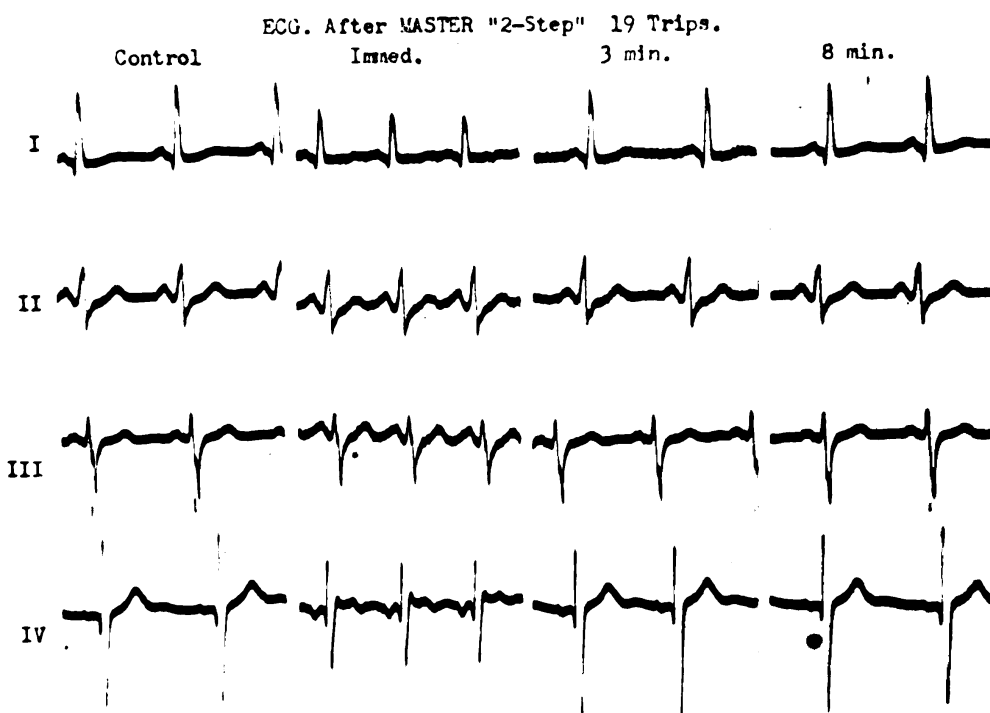
L.F.S. Capt. USN. 51. Cor. Heart Dis., Hyp.,Ac. Cor. Ins. 2/27/42

FIGURE 2B.—L. S., SAME PATIENT. RESULTS OF "2 STEP" TEST. CONTROL ELEC-
TROCARDIOGRAM SHOWED ONLY SMALL T_1 BUT IMMEDIATELY AFTER STANDARD
"2 STEP" EXERCISE T_1 BECAME FLAT, IN FACT SLIGHTLY INVERTED AND T_4
BECAME DEFINITELY INVERTED, THUS CONFIRMING THE DIAGNOSIS OF ACUTE
CORONARY INSUFFICIENCY.
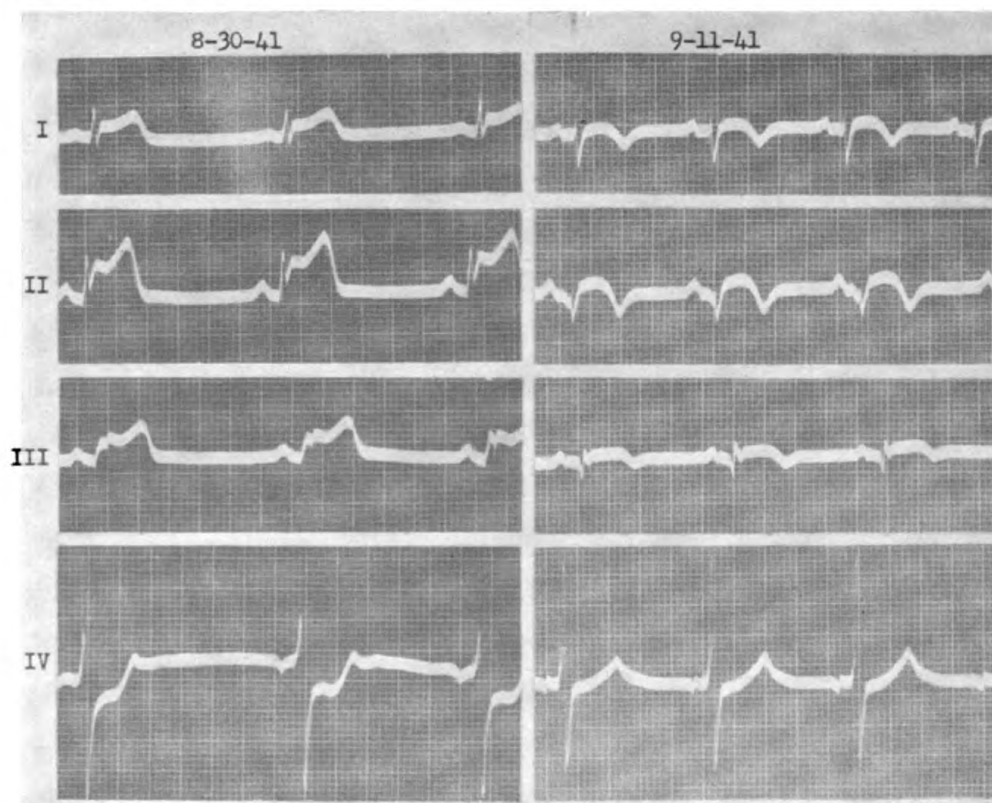
J.E.T. 44 - CGM., U.S.N., Acute Coronary Occlusion.

FIGURE 3.—J. E. T. (59544), MALE, 44. ACUTE CORONARY OCCLUSION. SUSTAINED ATTACK AUGUST 30, 1941, AT WHICH TIME THE ELECTROCARDIOGRAM REVEALED ELEVATIONS OF RS–T SEGMENTS IN LEADS I, II, III AND DEPRESSION IN LEAD IV. THE RS-T ELEVATIONS PROGRESSED INTO DEEPLY INVERTED COVE-PLANE T-WAVES (9/11/41) AND LARGE Q-WAVES APPEARED IN LEADS II AND III. THESE CHANGES ARE SEEN IN CORONARY OCCLUSION.

In contradistinction to these 2 cases illustrating attacks of acute coronary insufficiency we present Case 15:

J. E. T., a man of 44 who sustained an acute coronary occlusion with no apparent precipitating factor. The electrocardiogram (fig. 3) revealed elevation of the RS–T segments which progressed into deeply inverted ("cove-plane") T-waves and the development of large Q-waves in leads II and III, all characteristic and, in fact, probably pathognomonic of coronary occlusion.

The 9 patients described in table 1 are men ranging in age from 44 to 52—the average age being 49 years. They were for the most part on active duty. The underlying factor in all of them was coronary artery disease and hypertension. One had luetic aortitis and presumably luetic coronary arteritis. An interesting differential between coronary insufficiency and coronary occlusion is the exciting or precipitating factor. The precipitating factor in coronary insufficiency is similar to that of angina pectoris, of which coronary insufficiency is merely a more advanced form, that is, a more severe ischemia. Exertion, excitement, emotional and mental strain, overeating, smoking and drinking, the last three usually together, were factors. This is illustrated by the first case (A. F. B.).

This patient had worked from early morning till 10 p. m. each day continuously for 5 weeks preparing an important budget of his department to be presented to Congress. Moreover, he was to be present at the Congressional hearing. As the date of this presentation neared, he worked harder, became extremely tense, smoked excessively, and on the evening in question took a cocktail, sat down to a heavy dinner, having had no time for his noonday meal. Suddenly he developed severe chest pain, and the first medical officer to see him found him "in collapse, cyanotic, and with a thready pulse."

The exciting cause in the second case (W. S. D.) was a fall on the buttocks which precipitated the attack for which he was under treatment when recently observed. Several months previously his first attack had been precipitated by strenuous effort in pushing his stalled automobile.

The precipitating factor in patient number three (C. S. D.) was overwork. He was an engineer officer inspecting a battleship undergoing trial runs. He was working very hard with considerable running up and down ladders. His hours were long without chance of rest, and he was under considerable mental stress. He went to a restaurant and partook of a heavy meal during which his attack occurred. He also had taken a couple of "stiff" drinks to abort what he considered to be a chest cold, and had been smoking heavily prior to the attack.

The fourth patient's (J. C. F.) attack occurred under circumstances not entirely clear, although it appears that the patient drank to excess at times. His blood Kahn test was 4 plus.

The fifth patient (H. A. K.) was a physician who developed his chest pain while working very hard during a period of overhaul and

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TABLE 1.—*Acute coronary insufficiency*

	No. 1—60527	No. 2—58984	No. 3—60042	No. 4—60639	No. 5—60138	No. 6—60762	No. 7—60168	No. 8—60971	No. 9—60189
Name	A. P. B.	W. S. D.	C. S. D.	J. C. F.	H. A. K.	J. J. O.	L. S.	S. W.	W. K. S.
Rank	Lt. H. C.	Civilian	Cdr.	C. Y.	Cdr.	Congress	Captain	Congress	Lt. Cdr.
Work	Accounting	Clerk	Engineer	Small stores	M. C.	Congress	Engineer	Congress	M. C.
Age	52	55	44	46	34	44	51	52	47
Predisposing factors	CHD¹	CHD¹	CHD,¹ HYP²	CHD,¹ HYP,² Valv. dis.; Lues (Aortitis).	CHD¹	CHD¹	CHD,¹ HYP²	CHD,¹ Valv. Dis.	CHD,¹ HYP².
Exciting cause at onset.	Exertion, emotion, food, tobacco, liquor.	Pushing car and fall on buttocks.	Exertion, emotion, food, tobacco, liquor.	Liquor.	Exertion, emotion.	Cough?	Exertion, par. tachy., diarrhea.	Excitement, tobacco, liquor.	Exertion, excitement.
Pain duration	Severe, 1-2 hrs.	Slight, momentary.	Severe, 3 hrs.	Slight, momentary.	Oppression, momentary.	Heaviness, momentary.	Severe, all night. + (diarrhea).	Severe, 1-3 hrs.	Slight, momentary.
Shock or "collapse"	+	—	—	—	—	—	—	—	—
Nausea or vomiting	—	—	—	—	—	—	—	—	—
Heart	—	—	—	Sys. apex	—	—	—	Sys. apex and aorta.	—
Lungs	—	—	—	—	—	—	—	—	—
B. P.	122/84, no drop.	124/80, no drop.	166/110, no drop.	150/80, no drop.	130/80, no drop.	132/90, no drop.	140/84, no drop.	132/80, no drop.	144/98, no drop.
Ecg	T₁ flat	RS-T₁₋₃ dep.	T₃ sl. inv.	T₁ small, T₃ inv. Lt. vent. enl.	RS-T₁₋₃ dep.	T₁ inv. Lt. vent. el.	T₁₋₄ inv.	T₁₋₄ inv.	T₁ inv.
Fluoroscopy	—	—	—		—				—
X-ray	—	—	—	+++	—				
Heart function: "2 step"									
Ecg "2 step"	—++	++	—		—+	++	++		++
Ecg double "2 step"				++++					
Laboratory: Fever	—	—	—	—	—	—	—		—
W. B. C.	—	—	—	—	13,800	—	14,000		—
Sedimentation	—	18 mm.	—	—	—	—	17 mm.		—
Kahn	—	—	—	++++	—	—	—		—
Condition after attack	Excellent	Good	Excellent	Excellent	Excellent	Excellent	Good	Excellent	Good.

¹ Coronary Heart Disease.
² Hypertension.

installation of new medical equipment and supplies on the battle-ship to which he was attached.

The sixth patient (J. J. O.) developed a severe cough in the course of acute bronchitis and during a paroxysm of coughing suffered an attack of severe upper chest pain.

Perhaps the most interesting patient was case 7:

L. S. had a heart attack that took place at home under a combination of circumstances. He was suffering from an attack of diarrhea and also developed paroxysmal tachycardia which lasted about 20 hours. This patient had experienced attacks of tachycardia during the past several years. When the pulse rate had begun to slow from its rate of 180 per minute he started to take his daily exercise on a "Gene Tunney" apparatus. Shortly after starting the exercise, he developed chest pain but continued with the gymnastic activity in an endeavor to work off his pain, but to the contrary, his pain grew worse.

Without continuing further, it is seen that there were definite precipitating factors in all these patients who suffered attacks of acute coronary insufficiency.

The intensity of the pain in these patients with acute coronary insufficiency varied from slight to severe, and the duration of the pain varied from momentary to several hours, and in one case it lasted all night.

Transitory shock was present in the first (A. F. B.) and seventh (L. S.) patients. Nausea and vomiting were absent in all cases.

Transitory or unusual clinical findings on cardiac examination were not in evidence at all. In no case were impaired heart sounds, gallop rhythm, pericardial friction rubs, or arrhythmias encountered.

The blood pressure showed no significant drop in any of the cases. A blood pressure of 166/110, the highest in any of the group, was present in the third patient (C. S. D.). An important observation is that during the entire hospital stay of all these patients, which never was less than 10 days, and in some cases was several weeks, there was no significant drop in blood pressure. As a precautionary measure the patients were kept under observation for longer periods of time than was absolutely necessary.

The electrocardiographic findings are of extreme importance and are characteristic of acute coronary insufficiency. These are depression of the RS–T segments and T-wave inversion. No significant Q-waves and no RS–T segment elevations were observed.

Fluoroscopy was of moment only in a negative sense in that no reversals of pulsation as evidenced by systolic expansions of any portion of the left ventricular musculature were observed. This phenomenon is common in coronary occlusion (25).

The laboratory findings were all within normal limits except in two patients who had a slight leukocytosis and two who had moderate increase in sedimentation rate.

TABLE 2.—Coronary occlusion

	No. 10—60406	No. 11—60248	No. 12—60707	No. 13—60648	No. 14—60188	No. 15—59544
Name	W. G. B.	C. C. H.	J. J. M.	G. R.	R. M. R.	J. E. T.
Rank	C. B. M.	R. Adm	C. QM	Brig. Gen	Lt.	Ch. G. M.
Work	Ret.	Ret. Active	Ret	Ret.	Desk.	Active.
Age	64	59	56	70	52	44
Predisposing factors	CHD¹ HYP² Enl. heart	CHD¹ HYP² Enl. heart	CHD¹ HYP²	CHD¹ HYP²	CHD¹ HYP²	CHD¹
Exciting cause at onset	Church, 3 a.m	In bed, night	Reading, 9 p.m	Sitting, 11 p.m	In bed	Light, routine work, 10 a.m.
Pain duration	Severe, 1-2 days	—	Severe rt. upper qd. 2-3 days.	Pressure	Severe, hours	Severe, 3 days.
Shock or "collapse"	++	||	++	||	+|	+
Nausea or vomiting						
Heart: Rhythm	Aur. Fl.	Gallop.			Tachycardia	Tach. & A. F.?
Sounds			1° impaired	Impaired	Friction rub	1° impaired and rub.
Failure	++	+|	||	||	||	+|
Lungs						
B.P.	120/100 90/80	170/124 140/84	160/105 130/78	180/102	180/100 90/	120/78 100/70.
Ecg	Q₁-₃ T₁-₄ inv.	Q₁- T₁-₄ inv.	T₁-₄ inv. R-T₂-r-₄ dep.	Q₁Q₄ T₁-₄ inv.	Q₄ T₁-₄ inv R-T₂el	Q₁-₄ T₁-₄ inv. R-T₁-₂-sel. and R-T₄d. Reversal.
Fluoroscopy	Reversal	Reversal	—		Left vent. hyper.	
X-ray	Enl. heart L.V.H	Enl. heart	Enl. heart L.V.H			
Heart function: "2 step"						
Ecg "2 step"						
Ecg double "2 step"	++	+++				++
Laboratory: Fever	102°	100.2°	99.2°			102.5°.
W. B. C.		11,250	12,800			14,250.
Sedimentation	26 mm	24 mm	18 mm		25 mm	24 mm.
Kahn						
Condition after attack	Sick	Sick	Sick	Good	Sick	Sick.

¹ Coronary heart disease.
² Hypertension.

After recovery from the immediate attack, in practically every instance the patient felt well and was eager to leave the hospital after the first few days, in some cases after the first day.

Contrasted with these patients whom we have classified as suffering from acute coronary insufficiency, table 2 gives a summary of six cases of coronary artery occlusion (cases 10 to 15). These patients were in the majority of instances retired and any who were working had sedentary occupations. Only one was on active duty. The ages ranged from 44 to 70 years, the average being 57, somewhat older than the coronary insufficiency group. Again the pathological background was coronary heart disease, but hypertension was definitely present in five of the six patients. In regard to the precipitating factors, there were none. These patients had their attacks under the following circumstances: The first, case 10 (W. G. B), while attending a special morning church service at 3 a. m.; the second, case 11 (C. C. H.), while in bed at night; the third, case 12 (J. J. M.), while reading quietly in the evening; the fourth, case 13 (G. R.), while sitting quietly at home about 11 p. m.; the fifth, case 14 (R. M. R.), in bed; and the sixth, case 15 (J. E. T.), the pain began in the morning while engaged in very light mechanical work and became progressively worse throughout the afternoon and night.

In general the pain was severe and the duration ranged from a couple of hours to several days, in other words the pain is more severe and of longer duration than that of coronary insufficiency. Shock, nausea and vomiting were common.

Distinct abnormalities in the heart examination were evident. Auricular flutter occurred once; two cases of paroxysmal tachycardia and one of auricular fibrillation were seen. Impaired heart sounds, gallop rhythm and friction rubs were heard. A definite drop in blood pressure was observed and this fall would have been even more pronounced had the patients all been admitted directly after the attack, instead of several days later as happened in some instances.

The electrocardiogram, too, served as a characteristic, in fact, specific sign of coronary occlusion. There were large Q-waves and T-wave inversion in every instance and in two cases elevation of RS-T segments was present. A reciprocal relationship between lead I and III was observed in all instances, i. e. when T_1 was inverted T_3 was upright and when T_3 was inverted T_1 was upright.

Two patients were fluoroscoped and both revealed a reversal of pulsation, i. e. systolic expansion instead of systolic contraction. This too, like the electrocardiogram, is a characteristic sign of coronary occlusion (25).

The laboratory findings were of importance, slight fever, slight leukocytosis, and rapid sedimentation rates being regularly noted. The

fever and increase in leukocytes would have been more pronounced had they been obtained earlier in the disease.

The final differential point was the patient's condition. Five of the six were quite sick. In other words, the attack of coronary occlusion is a serious episode.

An ordinary episode of angina pectoris due to coronary artery disease is usually easily distinguished from the two more serious heart attacks that have just been described, i. e., acute coronary insufficiency and coronary occlusion. It is brought on by excitement, emotion, effort, exposure to cold, food, injection of adrenalin, insulin, hypertonic glucose, etc. The pain is usually slight and is relieved by nitroglycerine. There is no nausea or vomiting, no cardiac findings like arrhythmias, paroxysmal tachycardias, changes in heart sounds, appearance of a gallop rhythm or friction rubs. The blood pressure remains unchanged or may even rise in an attack. The electrocardiographic changes may be nil or reveal depressions of the RS–T segment. The laboratory examinations are entirely negative, i. e., no leukocytosis, increased sedimentation rate or fever. The patient, in fact, is in status *quo ante*, following the attack. There are no pathological changes in the heart. It is well nigh inconceivable that acute changes could take place in the myocardium when, for example, the patient develops 10 to 20 attacks a day between each of which he feels well.

From this minor episode of angina pectoris we pass on to the intermediate group, that is, acute coronary insufficiency, shown in table III, as we have just described it in our cases. It is a necrosis or infarction of the myocardium without occlusion. It is found to occur in patients with coronary heart disease, arteriosclerosis, aortic stenosis and aortic insufficiency, in leutic coronary arteritis, following effort, excitement, paroxysmal tachycardia, heart failure, operation, shock, infection and trauma. The duration of the pain is variable, cardiac manifestations and even shock may be present but usually to a much more limited extent than in coronary occlusion. The blood pressure may drop if the lesion is severe enough; however, this did not occur in any of our cases. The electrocardiogram reveals T-wave changes, RS–T depression (not elevation of this interval) and no Q-waves. The recovery is generally good, but fatal results occasionally occur.

Physiologically, the disproportion between the work of the heart and the coronary flow is greater than in the ordinary bout of angina pectoris and less than in the 100 percent closure seen in coronary occlusion.

Pathologically the lesion is a focal, disseminated process occurring in the subendocardium and the base of the papillary muscles. Its absence from the endocardium explains the nonappearance of mural thrombosis and embolization and its absence from the pericardium ex-

plains why pericardial rubs are not heard and why elevation of the RS–T segment in the electrocardiogram does not occur.

Coronary occlusion (table 3) gives a characteristic clinical and electrocardiographic picture. It is observed in patients with coronary heart disease and hypertension. It has no precipitating factor unless, perhaps, operation and shock with fall in blood pressure (21) (26) (27) (28).

TABLE 3.—*Differential diagnosis between coronary insufficiency and coronary occlusion—Master, Carroll, and Andrews*

	Coronary insufficiency	Coronary occlusion
Definition	Prolonged ischemia of the heart muscle with necrosis, but without occlution of the coronary artery.	Complete closure of the coronary artery with infarction of the heart muscle.
Physiology	Disproportion between work of the heart and the coronary blood flow.	Complete obstruction of coronary flow.
Pathology	1. Artery—Variable involvement. From normal to severe sclerosis. 2. Muscle—Focal disseminated involvement often microscopic. 3. Subendocardial, base of papillary muscles. 4. No mural thrombosis with embolization. 5. No pericarditis.	1. Artery—Invariably diseased. 2. Muscle—Confluent, massive infarction. 3. Thru and thru from endocardium to pericardium. 4. Mural thrombosis with embolization. 5. Pericarditis.
Predisposing	Coronary sclerosis_____ Hypertension, occasionally (or not uncommon). Enlarged heart_____ Aortic stenosis_____ Aortic insufficiency_____ Luetic coronary arteritis___	Coronary sclerosis. Hypertension, common.
Exciting cause	1. Same as for simple attack of angina pectoris, i. e., exertion, excitement, food, cold, adrenalin, insulin, intravenous glucose, etc. 2. Gastro-enteritis_____ 3. Excessive tobacco plus liquor. 4. Tachycardia_____ 5. Hemorrhage_____ 6. Operation_____ 7. Shock, or fall in blood pressure. 8. Heart failure_____ 9. Infection_____ 10. Trauma_____	None. 6. Operation ? 7. Shock, or fall in blood pressure ?
Age	Usually 20–70_____	Usually 50–70.
Pain	Variable, usually severe and fairly prolonged.	Severe, prolonged.
Effect of nitroglycerine	Variable, may relieve_____	Not relieved; may aggravate.

TABLE 3.—*Differential diagnosis between coronary insufficiency and coronary occlusion—Master, Carroll, and Andrews*—Continued

	Coronary insufficiency	Coronary occlusion
Nausea and vomiting	Uncommon	Common.
Heart and circulation:		
Shock	Rare except as a cause	Do.
Heart sounds	1. No change usually	1. Poor, embryocardia.
	2. Gallop rare	2. Gallop.
	3. No pericardial rub	3. Rub.
Blood-pressure	No change usually	Definite fall.
Tachycardia and arrhythmias.	Uncommon	Common.
Failure	do	Do.
Lungs	Clear	Often congested.
Vital capacity	Usually unchanged	Definitely diminished.
Blood velocity	do	Diminished frequently.
Venous pressure	do	May be increased.
Form of ventricular contraction.	Normal	Systolic expansion or reversal.
Fever	None or slight	101°–103° usually.
Leukocytosis	do	Constant.
Sedimentation rate	Normal or slight	Rapid.
Glycosuria		Often present.
Azotemia		Do.
Electrocardiogram	Characteristic pattern:	Specific pattern:
	1. RS–T depressions	1. RS–T elevations progressing to deeply—
	2. T-wave inversions	2. Inverted T-waves.
	3. No Q-waves	3. Large Q-waves.
		4. Reciprocal relation leads I and III.
Condition after attack	Usually good or excellent	Poor.
Duration of illness	Few days to weeks	Weeks to months.
Degree of recovery	Usually complete	Prolonged illness, earmarks of attack for years.
Prognosis of attack	Fatal outcome rare	Fatal outcome not uncommon.

If operation and shock are definite factors, then in the drop in blood pressure one may find an explanation for the frequent occurrence of the attacks at rest. Actually, we believe coronary artery occlusion to be an end result of the arteriosclerotic process which occurs spontaneously in sleep, at rest or during routine activity.

The pain in coronary occlusion is usually very severe, very prolonged and is not relieved by nitroglycerine; in fact, the latter may increase the pain and aggravate the patient's condition. Nausea and vomiting are frequent. Shock, definite changes in the heart sounds, gallop rhythm, friction rub, paroxysmal tachycardia and arrhythmias are common and the blood pressure usually falls markedly.

The electrocardiogram of coronary artery occlusion is specific for this condition, i. e., RS–T elevations progressing to inverted T-waves, presence of large Q-waves and usually a reciprocal relation between

leads I and III. Fever, leukocytosis, rapid sedimentation rates (after about the third or fourth day) are present.

The pathological picture (21) is usually a massive infarct through and through from endocardium to pericardium. The endocardial lesion is the cause of mural thrombosis with embolization and the pericardial lesion the cause of the pericarditis and friction rub. These are not found in coronary insufficiency.

We have used the term coronary occlusion purposely as we consider it a better term than coronary thrombosis. It has been shown pretty well that in the majority of the cases the occlusion is on the basis of an intimal hemorrhage (13) (14) (15) (16) (17) (18) (19) (20) (21) which may rupture into the lumen and be followed by a thrombosis secondarily, or a hematoma may form in the intima or subintima and slowly occlude the vessel completely without thrombosis at all in the lumen proper.

It must not be forgotten that in at least half the patients with coronary occlusion there is a prodromal or preliminary phase (29) (30) (31) characterized by a sense of pressure or pain which appears for the first time or if present before occurs more frequently, or more severely or in a new location. This happens anywhere from a few hours to a few days or even longer before the actual attack of coronary occlusion and must not be confused with the latter. This prodromal pain is similar in every way to the ordinary simple attack of angina pectoris, i. e., it is brought on by effort or excitement; there is no shock, no drop in blood pressure, no fever, etc., and this differs decidedly from the actual attack in which complete occlusion takes place. It is interesting to note that in this preliminary phase there are no electrocardiographic changes, no alteration in the physical examination, no fever, leukocytosis, etc. (29) (30) (31).

SUMMARY

Coronary heart disease is very common in the general population over 40 and likewise in Navy personnel at that age, hence the necessity for being on the alert at all times for this condition.

In a period of 4 weeks in a 250-bed general hospital 15 patients were found to have either attacks of acute coronary insufficiency (9 patients) or acute coronary occlusion (6 patients). Thirteen of the 15 patients were bed cases and the other 2 were examined on a regular follow-up visit.

Angina pectoris due to coronary disease as distinguished from the two diseases under discussion is a transitory attack of substernal or precordial pain precipitated by exertion, emotion, cold, trauma, ingestion of food, etc., and relieved by nitroglycerine. It is due to a temporary ischemia and is not accompanied by any acute pathological changes in the myocardium. Shock, vomiting, changes in the heart

sounds, heart failure and a drop in blood pressure are absent; the blood pressure may in fact rise. The electrocardiogram is unaltered or shows transient depression of the RS–T interval and inversion of the T-wave.

Acute coronary insufficiency as a rule, is associated with a precipitating factor, such as that seen in the ordinary attack of angina pectoris, but may also be seen in tachycardia, heart failure, acute hemorrhage, operation, shock, aortic stenosis or insufficiency, lues, etc., which reduce the coronary flow or increase the work of the heart and the oxygen requirement of the heart muscle. The clinical picture may resemble that of coronary occlusion, but pain and signs of shock may be absent or inconspicuous. Laboratory findings are minimal. Electrocardiographically, coronary insufficiency is characterized by depression of the RS–T segment and T-wave changes usually in two or more leads. If the factor producing coronary insufficiency is slight or is exerted briefly there may be no changes in the myocardium. If the ischemia is severe and prolonged it may result in focal, disseminated necrosis in the subendocardium and papillary muscles. The location of the lesion explains the absence of pericarditis and mural thrombi.

Coronary occlusion or thrombosis is a characteristic syndrome and presents specific electrocardiographic changes. Occlusion is a better term than thrombosis since it has been shown that the majority of occlusions are initiated by intimal hemorrhage and may form a complete arterial block without thrombosis. The acute attack occurs irrespective of external factors, such as effort and excitement, but may possibly be precipitated by operation and shock. The pain of coronary occlusion is usually prolonged and is unaffected or is aggravated by nitroglycerine. Shock, nausea, and vomiting are common. The blood pressure almost invariably falls, and distant heart sounds and gallop rhythm are frequently heard. Occasionally a pericardial rub is present. Heart failure often occurs and the laboratory findings, including fever, leukocytosis and rapid sedimentation rate, are always positive. There are usually residual symptoms for weeks or months. The electrocardiogram shows typical, progressive changes consisting of RS–T elevations and deep Q-waves; the former progress into T-wave inversions. There is usually a reciprocal relationship of the RS–T segments and T-waves in leads I and III. This specific electrocardiographic pattern is associated with a confluent, massive infarct extending from the endocardium to the pericardium and thus frequently giving rise to embolization and pericarditis. Fluoroscopy often reveals systolic expansion in an area of the left ventricle.

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THE EARLY MANAGEMENT OF BURN CASES IN MASS QUANTITY [1]

By Lieutenant Commander E. L. Caveny, Medical Corps, United States Navy

It occasionally becomes the duty of a naval medical officer stationed outside a hospital, or on independent duty, to render first aid to a large group of casualties which appear unexpectedly. This frequently may be the case as a result of actual combat.

The necessity of being prepared to meet any emergency was emphatically impressed on this medical officer as a result of the Japanese air raid on Pearl Harbor the morning of December 7, 1941. From this emergency certain lessons were learned, and a few will be discussed at this time.

The rapid transition from a relatively quiet and serene dispensary to one crowded with casualties is something to behold. This is to say nothing of the actual responsibility and the acuteness of rapid and accurate decisions required of the medical officer.

On the day of the above-mentioned attack, there were many injuries of all types brought into the dispensary of the Naval Air Station at Pearl Harbor. The exact number was not ascertained, but a rough estimate would be between 250 to 300. The reason that the unit received such a large number of injured was its close proximity to the damaged ships and to the greatest concentration of casualties. A large percent of the above number were burn cases and it is that group that will be discussed at this time.

From the manner in which the burns were handled from the beginning, in that primarily large quantities of sulfonamides were freely

used, their hospital course was followed with considerable interest. The writing of this paper has been intentionally delayed until final disposition of the majority of the cases. By so doing, it was felt that some conclusions might be drawn as to the effect of the early management and treatment prior to the arrival at the hospital and its effects on the ultimate results.

In the article by Lieutenant Commander N. T. Saxl, Medical Corps, United States Naval Reserve, that appeared in the United States Naval Medical Bulletin,[1] the hospital course of 254 burn cases resulting from the Japanese attack on December 7, 1941, was well covered. Medical officers who have not read that article are urged to do so. Anyone being in a position to actually see the extent of the burns reported can more readily appreciate the marvelous results obtained. Of the 254 cases covered in that report a conservative estimate is that two-thirds of that number were originally seen and treated at the dispensary of the Naval Air Station. It is definitely felt that the manner in which these two-thirds were handled, until the time of reaching the hospital, played more than a mere contributing factor in the favorable and gratifying outcome as reported.

Medical officers are cognizant of the fact that all such cases should be transferred to the hospital as soon as practicable. The hospital is far better equipped and staffed, especially to take care of such cases in mass occurrences. However, this is not always practicable, or possible, as was the case of December 7, 1941. Even though the hospital was a matter of 10 minutes by boat, it was several hours before evacuation of the patients from the dispensary to the hospital was begun, and it was the middle of the afternoon before the evacuation was completed. It is that intervening period, from the time of the accident until the admission to the hospital, that the following discussion of the early management of burn cases covers.

As the cases were brought into the dispensary they were laid on mattresses and covered with blankets; clean linen was used until the supply was exhausted. The mattresses and blankets were obtained by stripping the marine barracks. A number of marines were commandeered to tag each patient with name, rate, and station. However, this procedure was soon discontinued because after the first 40 to 50 patients, all tags had been expended. Many tags had to be replaced because of defacement from oil, a large number of these patients having emerged from oil-covered water. After the supply of tags had been exhausted, the emergency was too great to look for others. Many patients were in no condition to give the desired information. Here the urgent need for the metal identification tags, frequently referred to as "dog tags," was clearly demonstrable. This medical officer does

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[1] Saxl, Newton T.: Burns en masse. U. S. Nav. Med. Bull. 40: 570–576, July 1942.

not recall having seen one metal identification tag during the entire day. There was also an urgent need for more casualty tags which in the past were so often thrown around and were in the way in first-aid bags.

The patients were seen as soon as possible after arrival by a medical officer, and superficial examinations were made. Shock was treated immediately with disregard for other existing conditions. If shock was not present, its development was carefully watched for. All corpsmen and others acting as assistants were instructed to see that all cases remained perfectly quiet and that they were kept well covered. Even though the patients were instructed to remain quiet they would occasionally be found walking about looking for drinking water or a toilet.

Morphine sulfate was freely used. The "Syrettes" proved extremely applicable to such an emergency but, due to their limited supply, were soon expended. From then on morphine was used in a solution, one-fourth grain to the cubic centimeter. The "Syrettes" proved such a tremendous value from the standpoint of time saving and simplicity of use during such an emergency that this medical officer from that day assured himself that there would always be a sufficient number on hand to meet any substantial emergency. Practically all cases received an initial dose of one-half grain shortly after arrival.

This dosage proved sufficient to relieve pain in about two-thirds of the cases for the time that they remained at the dispensary. The remaining one-third received an additional one-fourth grain. However, it was later understood from the hospital that a number of the cases arrived there in considerable discomfort. This can readily be understood in that several hours had elapsed between the initial injection and the arrival at the hospital. This was no oversight. From the rushed, nonrecorded, and mandatory manner in which the drug was originally given, it was felt that it would be best to have the patient on the short side of sedation on his arrival at the hospital.

Shortly after the onset of the attack the patients arrived at such a rapid rate, suffering with moderate to extreme pain, that morphine was given at such a furious pace that no record or identification mark could be made showing its administration. That could have been alleviated, however, if some system of identification had been previously instituted. Each patient who maintained his mental faculties was instructed, at the time of injection, to report to any other medical officer attending him, that he had received morphine and the time of administration. An effort was made to tag, in some identifying way, the cases that were in shock, or not in full possession of their mental faculties. The dire need for some rapid and simple method of signifying that morphine had been given was strongly felt. The method of tying strips of green cloth, 4 inches by 24 inches, around an arm or leg would have fulfilled that need quite satisfactorily. A number of these strips should be kept available at all times.

There were four different types of preparations used to cover the burned areas. These were, first, tannic acid burn jelly as issued by the medical supply depots; second, freshly prepared 5 percent tannic acid solution; third, an aqueous solution of sulfanilamide, sulfathiazole, and sulfadiazine, of each grains 45 to 1,000 cc. of water; and, fourth, an oily solution of sulfanilamide grains 120, sulfathiazole grains 75, sulfadiazine grains 75, to 1,000 cc. of mineral oil.

The burned areas were all covered with one of the above preparations shortly after arriving at the dispensary. The medical officer, following his initial examination, would issue instructions to one of the corpsmen which of the preparations to use. The tannic acid jelly was used only on the first-degree burns and was readily applied with a wooden tongue depressor. The aqueous solutions were readily applied by means of a spray gun, but there were only two available for use. Many atomizers were put into use but they proved very slow and tiring. One regular size hand spray gun can do the work of a dozen atomizers and they should always be available for such an emergency. The oil solution was applied by means of either pouring it over the burned area or saturating a piece of gauze and covering the area. This gauze was spread out in a thin layer and left in place. The corpsmen assigned to the detail of applying the coating materials continued going from patient to patient applying additional coats. The number of cases that received tannic acid and the number that received sulfonamides was not ascertained but a fairly accurate estimate is that they were about equally divided. A most interesting point is that there was no apparent difference in the hospital course or final outcome between the two methods of treatment.

The thirst in these cases was intense and quite characteristic of that accompanying shock. This presented a problem from several points of view. The main water supply had been put out of commission and it was questionable as to whether or not the remaining supply was polluted or had been contaminated. The importance of having a storaged water supply in all medical activities was clearly brought out. Many of the cases were vomiting, and being unable to retain anything on their stomach, they still pleaded for water. They were all given small quantities from time to time. To give the patients water with the least amount of disturbance to them was quite satisfactorily done with the aid of a fountain syringe, a common enema can, with a small glass nozzle on the end of the tubing. The patient was instructed to lie still and simply open his mouth, and the can then raised slightly above the level of the nozzle.

It is interesting to note that many of these cases had a violent urge to defecate. They would frequently shout out their intense desire. The number of bed pans and other suitable receptacles was limited

and far inadequate. Even though the pans were slow in reaching them, and possibly never reaching some, no cases of soiling were noted. The desirability of having a number of easily movable excreta receptacles available for an emergency with a large number of casualties was clearly seen.

The method in which these patients were transferred from the dispensary to the hospital will not be discussed here as every locality presents a somewhat different problem. It will be stated, however, that once the patient was placed upon a mattress he was not removed until reaching the hospital. When it became necessary to move the patient he and the mattress were lifted as one and simultaneously placed upon a stretcher.

CONCLUSION

A brief résumé has been presented in the manner in which many burn casualties were handled at a naval dispensary before their transfer to a naval hospital. Many points, which normally are of minor importance, assumed aspects of major proportions during this emergency. It will be noted that everything done in the way of treatment was of an emergency and first-aid nature. No extensive treatment such as cleansing, debridement, or intravenous medication was attempted. The 40 packages of normal human plasma, 250 cc. each, on hand at the dispensary at the outbreak of the incident, were transferred to the hospital as soon as possible to supplement their limited supply.

The outline of the treatment as rendered has been given mainly because it is felt that it definitely was a contributing factor in the ultimate and gratifying outcome of those cases. The major pitfalls encountered during that emergency also have been given with the intention that other medical activities may profit by avoiding similar ones.

ORAL HYGIENE [1]

By Lieutenant Commander Merritte M. Maxwell, Dental Corps, United States Navy

In this age of military mindedness, it is but natural for us to concentrate our attention upon pertinent problems of the day, such as maxillofacial surgery, war wounds, and various reconstructive agencies of mechanical and surgical natures. As important, timely, and interesting as these subjects are, and even though it may require some effort on our part for the prosaic consideration of the unspectacular, it will be time well spent in emphasizing that important division of preventive dentistry, notably, oral hygiene.

A review of the Naval Medical Bulletin for the past 10 years reveals that there have been published two papers, which deal directly with the

accomplishment of oral cleanliness. One of these entitled, "Visible Tooth Cleaning" (1), describes an excellent type of tooth brush and stresses the necessity for the furtherance of the hygiene program in the Navy. The other article by Howell (2) demonstrates how effectively oral prophylaxis may be rendered in a well-organized dental activity.

The main purpose of this paper is to further emphasize the importance of a well-conducted oral prophylactic service and to present a plan that may be generally used in the Navy to effectively put the story across.

First, I should like to briefly review a few of the findings presented by various authorities, which will refresh in our minds the need of an efficient hygienic program.

Multitudinous are the statistics which have been accumulated in regard to the various aspects of the caries problem. We know that mouth hygiene *per se* is not the solution for this enigmatic disease, yet we are equally confident that a systematized method of mouth brushing plays an important role in the prevention and retardation of not only caries, but paradental disease as well.

Dental caries has been attacked from the bacteriologic, dystrophic, metabolic, endocrinic and morphologic battlefronts. Yet enemy caries, albeit somewhat weakened by the scientific onslaught is still with us. Certainly no criticism can justly be directed toward those untiring and unselfish workers in this field, for it may well be, that further research and correlation of the fruit of their labors shall one day give us the total answer to which we eagerly look forward. In fact, even a cursory review of dental and medical literature reveals that current and past investigations are responsible for the compilation of valuable data tending to solve the caries problem.

Miller's (3) chemico-parasitic theory, although not clarifying all the complexities of caries, is recognized by a number of authorities as being basically sound. His work has without doubt served as a splendid groundwork and inspiration for later investigations in regard to the part played by bacteria in dental caries.

It is interesting to reflect on the findings of Kligler (4) who has shown a quantitative decrease of 52,000,000 bacteria per milligram of material examined after brushing the teeth. He has also shown that there is an increase of 51,000,000 bacteria per milligram after meals. These figures may have little significance in relation to the value of mouth hygiene as an etiologic factor in caries, since they were determined in the case of patients having so-called healthy teeth. However, the pertinent fact seems to be that in the cases of those individuals having caries of the enamel and dentine there was a tremendous

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quantitative bacterial increase of from 200,000,000 to 400,000,000 bacteria per milligram of material examined microscopically.

Bunting (5) states that dental caries is chiefly due to the formation of acid by lactobacillus acidolphilus. Appleton (6) stated that:

In neglected or diseased mouths differences appear in the bacterial content. When the mouth is well cared for, the dominant flora is aerobic and facultative; when badly cared for, the flora is especially anaerobic, resulting in evident putrefaction. There are no true proteolytic anaerobes in normal mouths kept in a hygienic state.

He further demonstrates the efficacy of the toothbrush in reducing the bacterial content of the oral cavity, even though this reduction be transient in character. By bacterial counts he has determined that:

1. The number of bacteria was greater on rising than at any other time at which a count was made.

2. Vigorous brushing with tooth paste results in a marked drop.

3. After meals, with the exception of breakfast, the number shows an appreciable drop.

4. Between meals the number rises.

Recent research (7) has revealed that fluorine produces a direct limiting influence on caries production. Whether or not the use of dentrifices containing small quantities of fluorine will be of value remains to be seen.

Gottlieb and Orban (12) bring forth an interesting reflection on the value of oral prophylaxis.

If, in examining a case of chronic gingival inflammation, it appears that the mouth has been decidedly neglected from a hygienic standpoint, it might be well to consider the probability of this general lack of care as the causative factor of the existing inflammatory process. Instead of going through the involved procedure of differential diagnosis, it is simpler to render the mouth hygienically clean with careful oral prophylaxis, in order to determine if this procedure alone would not be sufficient to restore the mouth to normal.

Clinical observations over a number of years have demonstrated the value of mouth cleanliness in the prevention, retardation and treatment of pathology of both the hard and soft tissues of the oral cavity, despite the fact that in certain individuals with unhygienic mouths disease does not appear. Frequently it has been observed that these same caries-free persons seem to be especially prone to the inception and development of paradental disease, although Miller and Seidler (8) found no correlation between paradental disease and caries.

From the standpoint of hospital practice, numerous reports have been received in regard to the decreased incidence of postoperative pneumonias in those cases which have received thorough oral prophylaxis prior to the use of inhalation anesthetics.

J. Shaw Dunn of the chair of pathology, Birmingham, England, is quoted as saying that aspiration pneumonia is the commonest form

of postoperative pneumonia. Of 859 surgical patients given preoperative care, S. Franken (9) states that there was a measurable drop in post-operative pneumonias; his comparative figures in relation to the preoperatively untreated cases show a decrease in the incidence of pneumonia by two-thirds.

M. W. Carr (10) states:

Many factors are operative in the development of postoperative pneumonia. The great predominance of group IV pneumococci, the ordinary pneumococci of the mouth, supports the view that these pneumonias are of an aspirational type. Paradental disease, gingivitis, and stomatitis, in proportion to their severity and extent, furnish large numbers of bacteria. Under these conditions the aspiration of a minimum infective dose will be facilitated during general anesthesia and the prolonged inactivity of convalescence.

Sulser, Lesney and Fosdick (11) collected data on the reduction of breath and mouth odors by means of brushing the teeth. They used an osmoscope, an instrument for the determination of the odor intensity of air. Their findings are as follows:

1. Brushing the teeth with a flavorless dentrifice will reduce odors on an early morning breath 66 percent, general mouth odors 30 percent in aggregate.

2. After brushing the teeth 90 percent of the cases have mouth odors that would be inoffensive to most individuals.

3. Brushing the teeth with a dentifrice is more effective than brushing without a dentrifice.

The naval dental officer may carry on his campaign by two methods: first, by means of group instruction; and secondly, by individual teaching.

GROUP INSTRUCTION

1. By arrangement with the executive officer of a naval activity, time may be arranged for speaking to the various divisions, and citing the value and methodology of oral prophylaxis.

2. At assemblies of the ship's company, a short time may be obtained in which to disseminate pertinent facts in regard to mouth hygiene.

3. At such activities where motion pictures are presented, as a prelude to the feature picture, a short talk, some slides or an instructional movie may be presented.

INDIVIDUAL INSTRUCTION

Within his own office the dental officer has the best opportunity for emphasizing the importance of the hygienic program.

It is suggested that the dental officer have available for demonstration the following (see fig. 1):

1. An upper and lower model, or typodont with the full complement of teeth.

2. Two models showing the most frequently encountered edentulous spaces.

8. Two tooth brushes of proper design.

4. Dental floss.

5. Hand mirror.

It has been found beneficial to use models and tooth brush for demonstrating the proper technic of brushing, with emphasis being placed upon the development of a definite system. One arch is taken at a time, always starting to brush at the same place and going from one area to the next. That is, start with the upper right molar teeth, continue anteriorly step by step, and around to the external surfaces of all upper teeth. Then brush the distal surface of the posterior upper left molar and continue around the internal surfaces of the upper teeth and finally brush the distal surface of the posterior upper right molar. By commencing at a definite place and brushing all around the arch and returning to the starting point, the patient is certain that no areas have been missed. To complete the upper arch the masticating surfaces of the teeth are then brushed.

In a similar manner the lower arch may be systematically cleansed. Commonly neglected areas are the lingual surfaces of the lower bicuspids and molars. This is, no doubt, due to the fact that the tongue occupies this space, and it is somewhat awkward to properly manipulate the tooth brush in this region without instruction.

While demonstrating the various tooth brush positions it is imperative to stress the dual purpose of brushing, viz, not only cleansing tooth surfaces but also the mechanical stimulation imparted to the soft tissues for the preservation of their tonus. The friction of the bristles has a salutary effect upon the soft tissue comparable to the physiotherapeutic influence of massage or shampoo.

In a surprising number of cases it has been found that model demonstration alone did not suffice to put the story across. In order to supplement the oral instruction, frequently it has been necessary to have the patient brush his teeth before a mirror and go through the various movements in order to secure the "feel" of the correct procedure.

Variations in the brushing technic must be demonstrated for those patients having edentulous spaces, bridgework, and partial dentures. In those cases having missing teeth, the brush positions should be shown for cleaning the tooth surfaces approximating the edentulous space. According to the type of fixed bridgework present, the brushing must be modified, especially in those cases having so-called sanitary bridges where the under surface of the pontic and abutment margins are the most frequently neglected areas. Those patients having partial dentures should be shown how to meticulously clean all retaining fingers bars and clasps, especially where such devices contact the teeth (fig. 2).

To break the habit of haphazard mouth brushing is not always as simple as it may seem to be. Especially is this true with the older patients. Accordingly patients are advised to brush their teeth in front of a mirror for a sufficient period of time in order to habituate themselves to the proper stroking methods as well as to the systematic series of steps.
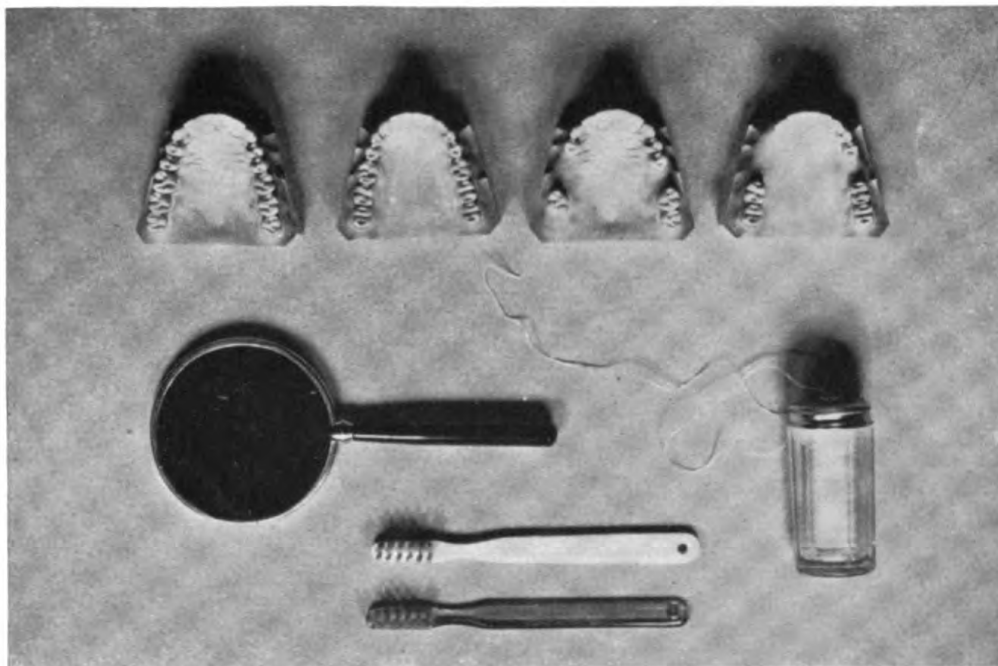
FIGURE 1.—ARMAMENTARIUM FOR INSTRUCTION IN ORAL HYGIENE.
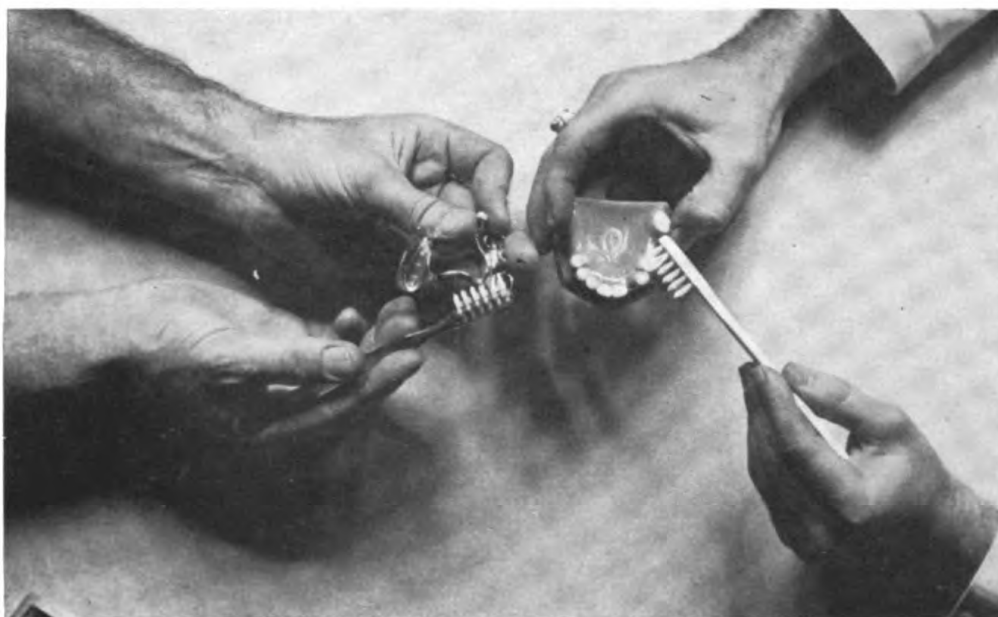
FIGURE 2.—SPECIAL BRUSHING TECHNIC FOR PATIENTS WITH DENTAL APPLIANCES.

FIGURE 3.—LESIONS PRODUCED BY "CROSS-BRUSHING."

It has been interesting to question office patients as to their hygienic habits. A large percentage of cases so interviewed have had the impression that they were efficiently and conscientiously brushing their teeth. In a number of instances these patients were asked to bring their tooth brushes to the office and demonstrate their method of brushing, and it was surprising to find that very often their mental picture of the procedure did not conform to practice.

They seemed to be predominantly conscious of only their anterior teeth, those which they could see, and paid scant attention to the posteriors. The brushing was found to be a haphazard process rather than a systematic method. They were generally tooth-conscious rather than mouth-conscious and did not realize the value of the mechanical stimulation derived from properly brushing the gums. The Fones' designation of the term "mouth brushing" rather than tooth-brushing is therefore seen to be of value for the reason that patients will better realize that cleaning the teeth alone is not the sole objective.

Yet again, we see patients who are confident that they are scrupulous in the care of their mouths, and to give them due credit, they do regularly brush their teeth; however, all too frequently it is apparent that they are victims of incorrect brushing habits. It is interesting to speculate on the amount of damage to both the hard and soft tissues resulting from these harmful habits. A survey showing the frequency rate of these traumatic injuries would be startling. Cross brushing of the teeth is particularly vicious (fig. 3). Clinical manifestations of tissue trauma and mechanical abrasion are almost daily occurrences in service practice.

Whether or not a patient should use dental floss, in my opinion, depends upon the findings of the dental officer. In those cases where the teeth have normal contacts, throughout the dental arches, it would seem to be inadvisable to recommend flossing the teeth because of the dangers associated with this practice. In other cases, the indications for using dental floss may be for only certain areas of the arch. The attention of the patient should then be directed toward caring for these specific areas.

Whenever flossing of the teeth is indicated it is important that this procedure be carried out properly. Again, with the aid of the hand mirror, the patient should be instructed in the technic of using the dental floss, so as to avoid injury to the interdental papillae. Snapping of floss through the contacts is to be particularly avoided.

The Services constitute an ideal field for spreading the gospel of mouth hygiene. Contrasted with civilian practice we have much better control of our patients with greater opportunity for favorably carrying out a hygienic program. The average Service patient is found to be most responsive and grateful for instruction which will be conducive to a higher degree of oral health and general well-being.

SUMMARY

1. Efficient oral hygiene plays an important role in the prevention, retardation and treatment of oral disease.

2. Advantage should be taken of all opportunities for the propagation of the oral hygienic program.

3. Dental activities should formulate plans for a systematized rendition of prophylactic service for personnel under their care.

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FUNCTIONAL HEART DISEASE IN THE EXAMINATION OF CANDIDATES FOR NAVAL AVIATION [1]

By Lieutenant Commander William Grady Mitchell, Medical Corps, United States Naval Reserve

Functional heart murmurs are found frequently, and other functional heart states occasionally, in the examination of candidates for naval aviation. The incidence of functional heart cases is about 20 percent in recruits examined for the various military branches. This percentage is less in cadets examined at Corpus Christi because they have already been subjected to at least two previous physical examinations before reaching this station and some of the more obvious and

disabling heart cases have been eliminated. The cases seen by the cardiologist are usually referred because of a heart murmur or an arrhythmia.

Since the candidates seen are chiefly those showing a functional heart murmur the greater part of the discussion is devoted to this subject.

MATERIAL STUDIED

Cases are constantly being referred for an opinion as to the cardiac status. One hundred cases are used for the sake of obtaining percentages. In this group of 100 cases, 80 percent were considered functional. This percentage includes all of the cases studied; that is, the obviously organic as well as the questionable cases. There were two definite cases of mitral stenosis, two hypertensive cases and one case of complete heart block. Of course, these cases were obviously organic. If they were eliminated from the material studied, the percentage of functional cases would be even higher.

METHOD OF EXAMINATION

The cases are studied at first without any regard to the murmur or other findings already detected. The chief complaint, if any, is noted and the man is questioned carefully regarding any etiological factor for heart disease. Because of the age group examined, i. e., men in the early twenties, a history indicating early rheumatic fever is sought. Polyarthritis is rarely found as a symptom of rheumatic fever in the South, but our candidates are also drawn from sections of the North and East in which rheumatic fever is very prevalent. Accordingly, they are questioned regarding polyarthritis, easily induced dyspnea, nose bleeds, frequent gastric upsets, rheumatic nodules, severe sore throats, scarlet fever, etc.

Hypertension, hyperthyroidism, an old luetic infection, and congenital heart disease must also be considered as causative in cardiac murmur production. Of course, it is not necessary to question the candidate regarding all the above possibilities because the majority of organic conditions are at once obvious. The rule is that he has no complaints and is surprised that he is under consideration for heart disease.

The man is stripped to the waist and a standard examination is made. With the patient standing and facing the light, careful inspection is carried out: the hands for rheumatic nodules, the fingertips for clubbing, the nail beds for cyanosis and pallor. Anemia can often be discovered by looking at the nail bed. It is an excellent colorimeter. Use your fingernail bed for a comparison.

A *café au lait* complexion, the distention of veins in the neck, abnormal pulsations, the displacement of the cardiac apex beyond the nipple line, precordial heaving or prominence, all these and other significant findings may be noted by inspection. May I emphasize, as has been done by many before me, that inspection is still the greatest means of diagnosis. This applies equally, or more so, to organic heart diagnosis than to other pathological states. A good history and thorough inspection will give the etiological diagnosis and functional capacity in practically all cases and these are among the most important considerations. Next in order, of course, is palpation for thrills and to confirm or disprove suspected enlargement. Percussion is used to check your impressions obtained by the above methods and auscultation is applied last. It is the least important method of examination of the heart except in the case of cardiac murmurs and even here the benign nature of a murmur is already suspected when no obviously abnormal physiological or anatomical condition has been found.

FUNCTIONAL MURMURS

As a rule, the cases referred have been rather well studied and obvious pathological states are not present. Instead there is merely a systolic murmur at some site over the heart, usually the apical area but frequently at the base of the heart. Murmurs at the apex, if not organic, are usually due to a rapid, excitable heart and are best heard after exercise with the patient in the left lateral decubitus position. This murmur is commonly found in young people when, after exercise or during excitement, the blood is expelled with greater speed and force from the heart into the vessels. Such murmurs are, of course, physiological. The other nonorganic and frequently heard murmurs are the cardio-respiratory murmurs. These murmurs are short and inconstant and of superficial quality. They may only be heard with the patient in the prone position and during inspiration, and are usually only audible over a relatively small area of the chest. The effect of suspended breathing should be observed. Their relationship to respiration and their inconstancy are the outstanding characteristics.

Systolic pulmonary murmurs are often heard. They are best brought out with the patient in the supine position and during expiration. They are probably caused by a dynamic dilatation—physiological—of the pulmonary artery. They are physiological.

The rubbing together of uninflamed pericardial and pleural surfaces may also cause murmurs. They usually disappear when the breath is held in expiration. It is the relative constancy and quality that distinguishes the organic from the functional or accidental murmurs.

The organic murmur is usually louder, harsher, and is constantly present. It is also heard as a rule in all positions. It may be better brought out and identified by exercise. This is noteworthy in mitral stenosis where the presystolic element of the murmur becomes more audible or the first heart sound more snapping in quality. The location of the murmur, the timing, its tonal characteristics and other accompanying abnormal findings make the case clear.

OTHER FUNCTIONAL HEART CONDITIONS

Arrhythmias are seen occasionally. I recently saw two cases with multiple ventricular premature contractions. The premature contractions were uniform in configuration and there was no evidence of organic heart disease present and yet it was considered advisable to reject them for flight training. Excitement caused an increase in the number of premature contractions and also complete "coupling." Such cases, under combat flying, could easily pass into ventricular tachycardia or ventricular flutter resulting in syncope or even death; hence, such patients are discharged from a flying status.

DISCUSSION

In aviation the cardiovascular system is important to maintain a normal metabolism in order that the different organs of the body may operate continuously at a high level of efficiency. It is especially important that a normal cerebral circulation be maintained to support consciousness. Armstrong states that high altitudes do not throw any undue strain on the circulation. Anoxemia causes a slight rise in blood pressure and pulse rate but no added myocardial requirement. This does not apply, however, when physical effort is necessary at high altitudes. Anyone experienced in mountain climbing knows how hard the heart "pounds" above 7,000 feet of altitude.

Cardiac efficiency is as equally dependent on neurocirculatory stability as on freedom from heart disease. The *Schneider Index* is helpful in this determination as it is probably the best circulatory-efficiency test applicable to aviation physical examinations. An *index* is obtained by assigning certain values to pulse and blood pressure readings in the reclining and standing positions, and before and after exercise. Tables of values are available from which we compute a certain number of "points," with 8 to 16 considered as normal. If one considers the various conditions such as fever, fatigue, a recent illness or excitement that will cause a false report and does not merely depend on a certain figure, the test will prove a helpful aid in detecting both organic and functional heart disease and possibly also some potential functional heart states.

As stated above, syncope may result from a tachycardia such as paroxysmal auricular fibrillation, auricular paroxysmal tachycardia, auricular flutter and multiple ventricular premature contractions. The latter, during excitement, may pass into ventricular tachycardia and possibly ventricular fibrillation. I believe these conditions may result at times without an organic background, or may be precipitated in organic heart disease by excitement in those with a susceptible nervous system.

Ordinarily heart murmurs are not difficult to gage if one first rules out the obvious organic states. If the murmur is systolic in time, not too loud and harsh, and heard in certain positions only, or, if it is superficial and related to respiration, being absent when the breath is held, such murmurs are typically functional. Of course, such cases are acceptable for aviation training. The greatest danger of mistake is caused by beginning with auscultation of the heart and ignoring other considerations in cardiac diagnosis.

The x-ray and electrocardiogram are rarely necessary in arriving at a correct opinion in cases that merely show a murmur, but such instruments are of value chiefly in congenital heart disease in the evaluation of the murmur and the anatomical abnormalities. Functional heart disease, as with other functional states, is diagnosed by the application of good judgment and investigation. Measures derived from "aids to diagnosis," are often the only procedures employed, and mistakes, obviously, are frequent.

Naturally, the electrocardiogram and x-ray are used routinely and they are helpful in the diagnosis of organic heart disease and especially is the electrocardiogram helpful in a study of the arrhythmias and occasionally in the detection of unsuspected cardiac conditions.

SUMMARY AND CONCLUSIONS

1. One hundred cases are used as a basis for this study of functional heart disease. Eighty percent of the cases were considered to be functional. They were passed for flight training.

2. The method of examination and reasoning used in arriving at an opinion as to the true cardiac state is discussed.

3. The majority of systolic murmurs heard in this age group are physiological. Nevertheless, a thorough study of each individual case is necessary to avoid serious mistakes.

4. Other functional heart conditions seen are also discussed. Certain benign arrhythmias call for rejection of the candidate because of their tendency under stress and nervous tension to pass into a more serious cardiac state.

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THE INACTIVATION OF INFLUENZA VIRUSES BY THE HUMAN SKIN [1][2]

By the Personnel [3] of Naval Laboratory Research Unit No. 1, United States Naval Reserve, University of California, Berkeley, California

As a part of the research program of this Naval activity we have been interested in compiling data about such properties of the influenza viruses as might be directly or indirectly concerned in transmission of that disease. In this connection Edwards (1) has shown that the PR–8 strain of type A influenza virus deposited on a sterile blanket survives drying under ordinary atmospheric conditions and subsequently can be dispersed into the air by shaking the blanket. Specimens of serge, sheeting, dust, and glass slides were soaked with virus suspensions, dried and kept at room temperature. By resuspending the virus in broth after various intervals of time and inoculating mice with aliquots of each sample, it was possible to make quantitative estimates of the residual active virus. Between 1 percent and 10 percent of the original virus could be recovered in this manner after 1 week in the dried state. These results clearly suggest the possibility that when articles are contaminated with influenza virus by patients who have this disease, they may serve as sources of infection for quite a long period of time after the virus-containing discharges are dried.

The dangers of transmission of other virus diseases by such means have been recognized. Thus the reports of the Foot and Mouth Disease Committee (2) include experimental evidence that the foot and mouth disease virus can remain active for several weeks in the dried state and that hay on which infected saliva has been dried can transmit the infection to calves who eat it as much as a month later. Similarly psittacosis is known to have been acquired by individuals who handled imported feathers originally plucked from infected birds (3).

The question has arisen whether influenza virus could survive in the dried state on human skin, in view of the fact that normally the skin has remarkable powers of self-disinfection. Many species of bacteria placed on the skin of the palm die off so fast that only 1 percent can be recovered in 20 minutes and in 30 minutes none can be found (4) (5). Certain organisms such as Esch. coli, E. typhi, and S. enteritidis were entirely destroyed in 10 minutes under these conditions. In Colebrook's (6) experiments 6 percent of the streptococci swabbed on the skin of the hand remained viable after 1 hour while only 0.02 percent grew after 2 hours. This self-sterilizing capacity is not dependent upon desiccation *per se*. It does not extend to the organisms which comprise the normal skin flora nor is it certain just to what biochemical processes the mechanism may be attributed.

The results of the experiments reported here indicate that influenza viruses in the dried state do not survive long on the palmar skin surface.

THE VIRUSES

The viruses used were the type A influenza virus, PR–8 strain, and the type B influenza virus, Lee strain. Both viruses were maintained in mice by frequent passage, and for experimental use virus suspensions were made by grinding the infected lungs with alundum, adding 10 cc. of broth at pH 7.6 for each gram of lung. Such 10 percent lung suspensions were then diluted 1:10 in broth to furnish the 1 percent suspensions used in the drying experiments.

The titres of the virus preparations employed were:

Type A virus, Experiment 1, mouse passage 360, titre 3×10^6 MLD's/ml.
Type A virus, Experiment 2, mouse passage 368, titre 6×10^8 MLD's/ml.
Type B virus, Experiment 1, mouse passage 87, titre 3×10^4 MLD's/ml.
Type B virus, Experiment 2a, mouse passage 92, titre 2×10^6 MLD's/ml.
Type B virus, Experiments 2b & 2c, mouse passage 97, titre 1.2×10^8 MLD's/ml.

EXPERIMENTAL PROCEDURE

Experiment 1.—The subject's hands were washed carefully with soap and water after which they were held under sterile towels for ½ hour. Next 0.2 cc. of a 1 percent virus suspension in broth was smeared over an area of 9 square inches on either palm. Of the same virus suspension

0.2 cc. was rubbed over like areas on two sterile Petri dishes. The time required for each smear to dry was noted and the sampling intervals were measured accordingly. An aliquot of the original suspension was kept at room temperature during the experiments as a virus activity control.

Ten minutes after drying, the contaminated areas on one palm and on one Petri dish surface were covered with 0.4 cc. of sterile broth. The underlying surfaces were thoroughly rubbed in order to resuspend the dried film; the latter could be seen to enter the broth as a dispersed phase. The resuspended preparation was then collected and tested for residual active virus by inoculating it into mice. Forty minutes after drying, the above procedure was repeated utilizing the contaminated area on the other palm and on the second Petri dish.

This whole test was carried out with both viruses, i. e., the PR–8 strain of type A virus and the Lee strain of type B virus. For each sample harvested three mice were inoculated with 0.03 cc. aliquots of the undiluted suspension and of a 1:10 dilution in broth. The animals were closely observed and those dying were autopsied at once. Records were kept of the days of death and the number of consolidated lobes found in each animal's lungs. After the expiration of 10 days, surviving mice were sacrificed and the extent of pulmonary lesions determined.

TABLE 1.—*Effect of skin-drying on influenza viruses—Experiment 1 (preliminary)*

Virus	Treatment	Time (minutes)	Final concentration after resuspension (as percent)	Mouse—		
				No. 1	No. 2	No.
Type A, PR–8. 1 percent mouse lung suspension.	Dried on hand	10	0.50	K_0	K_0	K_0
	do	10	.05	K_0	K_0	K_0
	do	40	.50	K_0	K_0	K_0
	do	40	.05	K_0	K_0	K_0
	Dried on glass	10	.50	K_4	K_4	K_3
	do	10	.05	K_0	K_0	K_2
	do	40	.50	K_3	K_3	K_1
	do	40	.05	K_4	K_3	K_3
	Undried control	10	.50	9_5	K_2	K_1
	do	10	.05	K_3	K_4	K_2
	do	40	.50	5_5	K_4	K_4
	do	40	.05	5_5	K_4	K_2
Type B, Lee. 1 percent mouse lung suspension.	Dried on hand	10	.50	K_0	K_0	K_0
	do	10	.05	K_0	K_0	K_0
	do	40	.50	K_0	K_0	K_0
	do	40	.05	K_0	K_0	K_0
	Dried on glass	10	.50	6_5	6_5	K_4
	do	10	.05	6_5	8_5	K_3
	do	40	.50	4_5	6_5	6_5
	do	40	.05	7_5	7_5	K_4
	Undried Control	10	.50	K_3	K_3	K_1
	do	10	.05	K_4	K_2	Lost
	do	40	.50	7_5	K_4	K_4
	do	40	.05	K_4	K_4	K_4

Column 4 is based upon the assumption that all the virus is recovered from the surface, i. e., the calculated values allow for dilution in the suspending medium.

The large figures in the last three columns record the days of death and the small subscripts enumerate the number of consolidated lobes in each case. K means killed on 10th day after inoculation and the subscript refers to the number of pulmonary lesions.

Experiment 2a.—The second experiment was conducted precisely as was the first, with the exception that an additional control was included. In order to expose the viruses to body temperature without direct skin contact, pieces of cellophane were glued to the palmar surfaces of two subjects and 0.2 cc. aliquots of the 2 virus suspensions were smeared over them. After drying 10 minutes and 40 minutes, samples were taken up in broth and tested for active virus by the technic used for the skin dried preparations. In general this experiment was better than the first one, not only because the cellophane control had been added but, also, because the undried preparations titrated higher.

Experiment 2b.—Because the recovery of Lee virus from the cellophane and glass surfaces was so low, experiment 2a was repeated as experiment 2b.

Experiment 2c.—This was a repetition of experiment 2b using thin rubber sheeting instead of cellophane over the palmar skin.

EXPERIMENTAL RESULTS

The relevant data from experiment 1 are summarized in table 1. Neither the PR-8 strain of influenza virus nor the Lee strain survived drying on the palmar skin surface for as short an interval as 10 minutes. The recovery of active virus from the glass surface after 40 minutes in the dried state was quite good. When the first experiment was repeated (experiment 2a) the type A virus dried on the palmar skin again was entirely inactivated within 10 minutes (see table 2). The glass-dried and cellophane-dried 40-minute preparations contained fully active virus. In comparison, the Lee virus withstood drying very poorly. While active virus was recovered from the 10-minute glass-dried material only occasional lesions were produced by both the 40-minute glass-dried and 40-minute cellophane-dried samples.

Repetition of the experiment with the Lee strain (experiment 2b) employing another virus suspension gave essentially the same results (table 3). Very little virus could be detected in the resuspended material from either the cellophane or glass surfaces after 40 minutes in the dried state.

In experiment 2c, thin rubber sheeting, instead of cellophane, was attached to the skin. No virus at all was obtained in the 40-minute sample from this surface (table 3). Inoculation of 6 mice with the corresponding 40-minute glass-surface-dried virus preparation resulted in the development of only one lesion in each of two animals.

TABLE 2.—*Effect of skin-drying on influenza viruses—Experiment 2a.*

Virus	Treatment	Time (minutes)	Final concentration after resuspension (as percent)	Mouse—		
				No. 1	No. 2	No. 3
Type A, PR-8. 1 percent mouse lung suspension.	Dried on hand	10	0.50	K_0	K_0	K_0
	do	10	.05	K_0	K_0	K_0
	do	40	.50	K_0	K_0	K_0
	do	40	.05	K_0	K_0	K_0
	Dried on glass	10	.50	9_5	K_4	K_4
	do	10	.05	K_1	K_2	K_2
	do	40	.50	5_5	5_5	6_5
	do	40	.05	5_5	6_5	7_5
	Dried on cellophane attached to palm.	40	.50	8_5	8_5	8_5
	do	40	.05	7_5	8_5	9_5
	Undried control	10	.50	4_5	4_5	5_5
	do	10	.05	4_5	5_5	8_5
	do	40	.50	4_5	4_5	5_5
	do	40	.05	4_5	5_5	K_4
Type B, Lee. 1 percent mouse lung suspension.	Dried on hand	10	.50	K_0	K_0	K_0
	do	10	.05	K_0	K_0	K_0
	do	40	.50	K_0	K_0	K_0
	do	40	.05	K_0	K_0	K_0
	Dried on glass	10	.50	4_5	5_5	6_5
	do	10	.05	6_5	K_3	K_3
	do	40	.50	K_2	K_1	K_2
	do	40	.05	K_0	K_0	K_0
	Dried on cellophane attached to palm.	40	.50	K_2	K_0	K_0
	do	40	.05	K_1	K_0	K_0
	Undried control	10	.50	6_5	8_5	8_5
	do	10	.05	6_5	8_5	K_4
	do	40	.50	5_5	6_5	8_5
	do	40	.05	5_5	6_5	8_5

Column 4 is based upon the assumption that all the virus is recovered from the surface, i. e., the calculated values allow for dilution in the suspending medium.

The large figures in the last three columns record the days of death and the small subscripts enumerate the number of consolidated lobes in each case. K means killed on 10th day after inoculation and the subscript refers to the number of pulmonary lesions.

TABLE 3.—*Effect of drying type B influenza virus on glass, rubber and cellophane surfaces*

Virus	Treatment	Time (minutes)	Final concentration after resuspension (as percent)	Mouse		
				No. 1	No. 2	No. 3
Type B, Lee. Experiment No. 2b.	Dried on glass	10	0.50	6_5	7_5	8_5
	do	10	.05	8_5	8_5	12_5
	do	40	.50	9_5	10_5	K_3
	do	40	.05	K_1	K_1	K_1
	Dried on cellophane attached to palm	10	.50	10_5	K_2	K_3
	do	10	.05	10_5	K_1	K_1
	do	40	.50	K_1	K_1	K_2
	do	40	.05	K_1	K_0	K_0
	Undried control	40	.50	4_5	4_5	5_5
	do	40	.05	5_5	8_5	10_5
Type B, Lee. Experiment No. 2c.	Dried on glass	10	.50	K_1	K_0	K_0
	do	10	.05	K_0	K_0	K_0
	do	40	.50	K_0	K_1	K_1
	do	40	.05	K_0	K_0	K_0
	Dried on rubber sheet attached to palm.	10	.50	3_5	7_5	10_5
	do	10	.05	K_0	K_0	K_0
	do	40	.50	K_0	K_0	K_0
	do	40	.05	K_0	K_0	K_0
	Undried control	40	.50	6_5	7_5	8_5
	do	40	.05	8_5	8_5	8_5

Column 4 is based upon the assumption that all the virus is recovered from the surface, i. e., the calculated values allow for dilution in the suspending medium.

The large figures in the last three columns record the days of death and the small subscripts enumerate the number of consolidated lobes in each case. K means killed on 10th day after inoculation and the subscript refers to the number of pulmonary lesions.

DISCUSSION

It may be concluded from the experiments reported here that type A influenza virus is rapidly inactivated when dried upon the skin of the palm. The experimental controls indicate that this loss of infectiousness is not due to desiccation alone, for the samples dried upon glass surfaces retained their ability to produce characteristic pulmonary lesions in mice. Similarly the virus survived very well when dried upon cellophane strips attached to the skin of the palm, so the results cannot be ascribed to thermal destruction at body temperature.

The value of an intact skin surface as a protection against bacterial infection is well established, but the functioning of the protective mechanism beyond offering a mechanical barrier has not been clearly analyzed. Arnold and his colleagues (4) (5) found the pH of the normal skin to range between 5.8 and 5.2 and they considered that H+ ions play an important part in autosterilization. This would appear not to apply in the present situation for it is known that PR–8 virus can withstand a pH of 5.0 for well over 1 hour (7).

Fleming (8) (9) (10) has reported the presence of lysozyme in the skin as well as in various other tissues. Lysozyme in considerable dilution lyses many non-pathogenic bacteria and also acts upon some strains of staphylococci and intestinal streptococci. It requires higher concentrations however, to produce any measurable effects on most pathogenic organisms. In view of this and because many of the bacteria which disappear rapidly from the skin surface are not susceptible to the action of lysozyme, its role in the skin's self-disinfection process appears unimportant. As far as the viruses are concerned, the experiments of Trillat and Beauvillain (11) supply indirect evidence that influenza virus is resistant to inactivation by lysozyme. These workers succeeded in transmitting influenza to ferrets by exposing the eyes of the animals to air contaminated with virus. Since the conjunctival secretion has a high content of lysozyme and the virus necessarily entered the body in contact with the secretion there is reason to conclude that this substance had not destroyed the virus.

Whatever the mechanism, the fact that type A and B influenza viruses are rapidly inactivated by the skin of the hand has certain public health implications. The spread of influenza from the infected patient to new victims by means of virus-containing droplets, sprayed into the atmosphere during coughing or sneezing, has been recognized for many years. Recent work has indicated that infectious nuclei, dispersed into the air along with the macroscopic droplets but smaller than the latter, are even more important for they remain suspended over much longer periods of time.

Edwards' observations (1) emphasize the dangers that arise from the deposition of influenza virus on sheets, blankets or dust. Dried on

these materials, the infectious capacity may be retained for weeks in some instances; and, one might be inclined to assume, on this basis, that virus dried on the human skin would survive in similar fashion. However, our findings show that heavy inoculations of types A and B viruses lose all infectiousness within 10 minutes after drying on the palmar skin. There seems little likelihood, therefore, that the spread of influenza from one person to another through manual transfer of virus is a major epidemiological factor.

The experimental data on drying of type B virus cannot be interpreted in quite the same way. Two experiments performed with the Lee strain left in the dried state for 10 minutes on the palmar skin showed that no virus remained in the active state. Drying on glass, in experiment 1, did not reduce the infectiousness of the virus even after 40 minutes. However, in experiment 2a very little active virus was obtained from the glass surface at the end of the 40-minute period, and this was true also in experiments 2b and 2c. When the capacity of the virus to survive drying on cellophane or thin rubber sheeting attached to the palmar skin was tested (experiments 2a, 2b, 2c) it was found that only enough remained to produce occasional lesions in mice.

In view of these findings, no special significance can be attached to the failure of Lee virus to survive drying on the skin of the hand. Drying on any surface, e. g., glass, cellophane, or rubber, appears to reduce its infectiousness, although the skin-dried material is inactivated somewhat more rapidly.

SUMMARY

1. Type A influenza virus was tested for its ability to withstand dessication on the human skin, on glass surfaces, and on strips of cellophane, adherent to the skin. Similar tests were conducted with type B virus, using, in addition, virus suspension dried on thin rubber sheeting attached to the skin.

2. Both types of influenza virus were completely lacking in capacity to infect mice after 10 minutes in the dried state on the human skin. The type A controls dried on glass and on cellophane for 40 minutes showed no drop in virus activity, while type B controls dried on glass, cellophane, or rubber sheeting lost their infectiousness nearly as rapidly as the skin-dried virus.

CONCLUSIONS

1. The skin of the hand is capable of destroying heavy inocula of dried influenza viruses (types A and B) within a few minutes.

2. Type B influenza virus is more susceptible to inactivation by drying than is type A.

3. Manual transmission of dried influenza viruses is not apt to be an important hazard in spreading the disease.

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THE COLORING OF DENTURE PLASTICS[1]

By Lieutenant Commander A. H. Grunewald, Dental Corps, United States Navy

Since the publication of a report [2] by this writer which referred to the coloring of powdered Lucite [3] for denture purposes, numerous letters have been received from civilian dentists and dental officers which spoke of difficulties encountered, with each new purchase of pigments, in obtaining suitably colored dentures.

Pigments purchased under the same name from different manufacturers often vary in color. This variation may be so great as to make it impossible to properly balance the suggested pigments by merely varying the proportions of each in the given formula. Recognizing this uncontrollable color factor in these pigments, it can be seen that it is impossible to obtain a suitable formula for coloring which could be used universally with unvaried and satisfactory results.

The inorganic pigments used for this purpose are salts of metals or combinations of such salts. It is a difference in the proportions of

the respective salts in a combination, or the presence of impurities, which causes the color variation. Endeavor was made to obtain a suitable coloring formula that utilized chemically pure salts only. It was felt that such a formula could be used universally and the required salts could be obtained from dealers in pure chemicals anywhere in the world. This, of course, would be important to the Navy, where one may be far removed from a particular dealer who had been supplying a suitable pigment.

Vermilion and pale shade vermilion were the pigments originally suggested as most suitable for the intended purpose. Vermilion, however, is not an invariant color. One would assume that mercuric sulfide, the basic salt from which vermilion derives its color, in the chemically pure state would possess invariably the same color. This is not always true because different batches of mercuric sulfide, from the same manufacturer, although listed as being chemically pure, actually vary slightly in color. Possibly, this can be explained, in part, by assuming that different conditions of manufacture may result in a variation in the structural alignment within the molecules of the pigment which influences its reflection of light, but not its chemical properties. Also, such variation in color may be due to minute impurities which may be present in different proportions without the salt being classified as chemically impure. Again, the state of subdivision has an effect upon the relative spectral distribution of reflected wave lengths. It is a matter of observation that by merely grinding mercuric sulfide particles, the apparent color average value is changed from red to orange, namely, the effective wave length of the reflected light is decreased.

Notwithstanding the above possibilities, the color variation in the chemically pure salt is so small as to be almost negligible.

The difference can be corrected by varying, in a formula, the amount of a second pigment that had previously proven to be satisfactory.

Mercuric sulfide is a common pigment, easily obtained. It is practically insoluble, very near the color desired, and not expensive; therefore, it is the pigment of choice. After trying various proportions of mercuric sulfide, with zinc oxide as the vehicle, it was found that the red color resulting was not dark enough; it was too near orange to be used alone. A basic salt having a darker red hue was required which when added to the mercuric sulfide would throw the color over to a darker shade and away from the entirely unsatisfactory orange. After considering the pigment salts that might be used for the purpose, it became apparent that the number of nontoxic salts that could be used were extremely limited. In fact, about the only one that appeared to show promise was ferric oxide.

A supply of ferric oxide was obtained and a color combination with mercuric sulfide and zinc oxide was determined which proved to be satisfactory for the purpose. A subsequent supply of ferric oxide in a chemically pure state was obtained which proved to be entirely unsuitable. This was due to the brown color resulting when it was combined with mercuric sulfide. A check on the original ferric oxide revealed that it was not chemically pure, but was a technical salt which contained impurities that altered its color so as to make it ideal for the purpose. A chemical analysis was then undertaken of the technical salt in an endeavor to determine what possible additional salt might be present which could be added to the formula to obtain the result desired. This proved fruitless, however, for while several impurities were determined, their addition to the formula failed to provide a satisfactory end result.

The list of basic salts that might serve to replace or improve upon the ferric oxide used in the formula was referred to again. After trying every possible pure salt that might serve, it became obvious that one could not be found. It appears that there is no chemically pure salt available that would produce unvaried results and that could be used universally for this purpose.

A chemical analysis of most of the denture materials on the market showed that an organic dye was used as the coloring agent. As titanium oxide was present it was assumed that the latter was used as the vehicle or smearing agent. Assuming that the yellow shade zinc oxide possesses might be responsible for the orange color obtained in certain mixtures with mercuric sulfide, titanium oxide (which is pure white) was tried in place of zinc oxide. This did not provide a satisfactory color, nor was it so suitable as a vehicle when inorganic pigments were used. The possibility of using organic dyes for the purpose was then studied. It was assumed that they might be satisfactory if the dyes were purchased in sufficient quantity to permit a manufacturer to produce certain colors to specification. Otherwise, where small quantities are required, the use of inorganic pigments would be preferable. The inorganic pigments are definitely stable, though slightly more expensive. It is necessary to run tests on the finished products when organic dyes are used if one is to be sure of lasting color stability.

Thus far, the findings show that it will be necessary to allow for a variation of color in each purchase of pigment. It seems impossible to obtain a suitable color formula employing chemically pure basic salts that requires no rebalancing. Technical salts, on the other hand, will vary sufficiently with each batch manufactured to require rebalancing the formula with each new supply. It is believed, however, that there is less risk of much variation and less balancing required when chemically pure salts, such as mercuric sulfide, and a technical salt,

such as ferric oxide, are used. When technical salts are purchased it is well to notice the batch number on the container. If a satisfactory color combination is obtained a supply of the same batch large enough to last for years can be purchased for a few dollars. For example: At 30 cents a pound and using the formula given below, enough of this pigment to color over 450,000 dentures could be purchased for $3.

The formula found most satisfactory is as follows:

Mercuric sulfide, C. P.. 800 mg.
Ferric oxide (technical).. 100 mg.
Zinc oxide.. 5 grams.

Thoroughly mix together using a mortar and pestle. Sift through gauze to remove lumps and add 1 gram of the resulting powder to 150 grams of hard, fine, powdered methyl methacrylate. Mix thoroughly, again using mortar and pestle.

A so-called "bootleg" denture material subsequently analysed proved to be colored with cadmium salts, undoubtedly cadmium red. Cadmium red is really cadmium sulfide and cadmium selenide and the color of the salt varies with the amount of selenium it contains. The writer has not worked with this salt.

Letters from civilian and naval dental surgeons indicate that difficulty has been experienced in obtaining hard, fine, powdered Lucite and monomeric styrene. The war has affected the supply of these materials still further. The writer recently was informed by the Bakelite Corporation that monomeric styrene (XRS–12471), which served as a satisfactory monomer, would not be available for the duration of the war. The DuPont Corporation has been hampered in selling Lucite, not only to the dentist direct, but, apparently, to any jobber who might in turn permit anyone to obtain it for use as a denture material. After using the regular powdered Lucite for several years in the preparation of hundreds of dentures the writer is convinced that it is entirely satisfactory.

Priorities have also entered the picture. Even before the declaration of war, the supply of plastics, except in the form of the regular trade brands through dental supply dealers, was practically stopped for the civilian dentists. As priority restrictions are intended to assure an adequate supply of materials to the armed forces for the prosecution of the war, the naval dental officer is not affected as is the civilian dentist. At least, the author has been able to obtain the necessary ingredients to make such denture material as was required by service personnel under his care. To avoid delay in the delivery of required materials the order should be made on the Supply Department which is conversant with the materials. Different Navy Yard activities have occasion to use the same material for other purposes.

Hard, fine, powdered methyl methacrylate (Lucite) has been obtained from the DuPont Corporation. The uniformly fine powder

is satisfactory, but it may vary somewhat with different shipments. If many coarse particles are present they should be sifted out and subsequently used for making additional liquid.

While monomeric styrene was considered a satisfactory liquid (monomer) to use with the Lucite powder, methyl methacrylate monomer is considered superior. When ordering the methyl methacrylate monomer it is advisable to request that it be inhibited with 0.05 percent of hydroquinone. Hydroquinone does not affect the quality of the finished denture. When gallon quantities are obtained it prevents the monomer, in hot climates, from polymerizing in the container. Also, it reduces the setting time of the final mix of the powder (3 parts) and liquid (1 part) and allows for sufficient time to properly pack the denture mold. It is essential that the amount of inhibiter desired be plainly specified when ordering the monomer. Failure to do so leaves the amount of inhibiter to be added entirely up to the manufacturer, who may add amounts that will make the monomer entirely unsuited for the intended purpose. For example, it was found that one supply of monomer, inhibited with 0.15 percent of hydroquinone, would not, when mixed with the powder, permit even near complete polymerization after placing the mix in boiling water for 2 hours. Should a quantity of monomer be obtained which has been over-inhibited the excessive hydroquinone can be removed by merely distilling the liquid at 100 degrees centigrade, using an all-glass still. Five hundredths of 1 percent of hydroquinone, or slightly more if preferred, may then be readded to the monomer. Should distillation be necessary, it should not be done over an open flame or in a closed room. Methyl methacrylate vapor is both inflammable and poisonous, although, if the operator takes normal, intelligent precautions, the hazard is not great.

In the event that synthesized methyl methacrylate monomer is not obtainable, there are two other substances that can be used as substitutes. One is Bakelite's styrene liquid XRS–42. This has been obtained although it may be restricted in the future. It is not satisfactory because of the bluish tint it imparts to the finished denture, which may be compensated for by altering the coloring formula accordingly. A second monomer can be obtained by cracking the polymer. Either Lucite or Plexiglas (both are methyl methacrylate) in any obtainable form, such as broken airplane windshields, can be used for the purpose.

The method of cracking is as follows:

Place pieces of polymer (methyl methacrylate) in a distilling flask and add enough sand almost to cover the pieces (or set the flask in a sand bath). This will disseminate the heat and prevent unnecessary charring of the polymer before volatilization takes place. Set prepared flask on an electric heating element and use an all-glass, water-cooled condenser. Raise the heat until volatilization starts and then maintain a volatilizing temperature until distillation is complete

(250° to 300° C.). Discard the residue left in flask. The yield of liquid from this distillation is about 95 percent by weight.

Redistill the first distillate at a temperature of 100° C. Maintain the temperature at 100° C., during the entire second distillation and discard such liquid in the flask as does not volatilize at 100° C. The yield of this second distillation is about 98 percent, making a total yield of suitable liquid from the original solid of about 88 percent.

A glass distilling flask should be used for redistilling the liquid. A glass distilling flask may be used for cracking the polymer. Considerable difficulty may be experienced in removing the residue from the flask and flasks may be broken as a result. This difficulty can be overcome, to a large extent, by using a specially made distilling flask, similar in shape to the standard glass flasks but having a cast iron bottom half and a copper top half. To permit placing larger pieces of polymer in the flask and to facilitate removal of the residue such a flask should be made to come apart near the center. If a glass distilling flask is used its cleaning can be simplified considerably by pouring a solution of alcoholic potassium hydroxide[1] in it and allowing the residue to soak for 24 to 48 hours.

As previously stated, either hard Lucite or Plexiglas can be broken down into a suitable monomer. When the monomer obtained from either of the above is mixed with a suitable powder a sufficiently rapid polymerization of the mix takes place. In fact, the setting time of the final mix may be too rapid to suit certain operators, but this can be controlled, and prolonged, by adding 0.05 percent of hydroquinone, or more if desired, to the monomer.

Scraps of Lucite or Plexiglas that are cut from sheets used in fitting airplane windshields, etc., as well as the broken windshields, are satisfactory, especially at this time. The new sheets of the material come covered with paper to prevent marring during transit. This should be removed, prior to breaking the material into pieces small enough to enter the distilling flask. The paper can be pulled off easily, but if difficulty is experienced saturate the paper with benzine for a minute or two. Many of the broken windshields or gun turret sections, made of methyl methacrylate, may have electrician's tape around the border. This should be removed by chipping off the part of plastic it covers with a pair of heavy wire cutting pliers, namely, by taking a small bite with pliers and twisting, so as to crack it off rather than endeavoring to cut through it. The usable pieces of plastic should be broken into sizes small enough to enter a distilling flask. This can be accomplished by hitting the material solidly with a hammer over a semisharp piece of metal. The latter should be secured to the side of a box which will facilitate the catching of the broken pieces.

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[1] KOH grams, 120 ; H_2O cc., 120 ; C_2H_5OH qs. cc. 1,000.

It is not necessary to separate the pieces of Lucite and Plexiglas. Other plastics, however, that may be used should not be mixed with the two above. One in this category, relatively little used, is cellulose acetate. Cellulose acetate can be distinguished from Lucite or Plexiglas by abrading the pieces with a file until heat is developed and noting the camphorous odor produced. In the case of Lucite or Plexiglas the resulting odor is that characteristic of the methyl methacrylate resin. If a further proof is required, testing solubility in acetone may be done. Cellulose acetate is soluble in acetone. Methyl methacrylate resin is not. It may be well to mention here that Lucite or Plexiglas are quite readily soluble in ethylene dichloride. A very tenacious glue is produced when Lucite is dissolved in this solvent.

Having found a satisfactory method of coloring Lucite powder, as well as a dependable supply of suitable monomer, the only ingredient remaining, for which dependence must be placed upon the manufacturer, is a suitable powder. The author is not aware of patent infringement occurring when methyl methacrylate monomer is obtained by the method described in this paper. At present there are only two known methyl methacrylate resin powders that are suitable for denture uses, namely, Lucite and Crystalite. War requires much methyl methacrylate resin plastic and it may be impossible to obtain an adequate supply of the material in the desired form. Scrap resin, previously mentioned, would have to be used. Lucite powder, under a magnifying glass, is made up of tiny droplets or spheres. Methyl methacrylate resin powder is made by polymerizing the monomer into powder form. This is done by adding a catalyst, such as benzoyl peroxide, to the monomer (to hasten polymerization) and then spraying the liquid against a revolving disk in a temperature-controlled heating chamber at about 120° C. Another method employed is to place the monomer, with the required catalyst, in a liquid bath (Na_2HPO_4, NaH_2PO_4, lecithin and H_2O), and at about 80° C., stir rapidly until the monomer polymerizes as small spheres out of the solution. The spheres then are filtered off and washed well to remove all of the emulsifying agent. This is done regardless of the ultimate use of the powder. There are other emulsifying agents and catalysts that can be used in different ways to obtain the desired powder. All of the methods known to the author are covered by patents and their use would result in infringement. It does not follow, however, that a method of making a satisfactory powder, from discarded scraps of methyl methacrylate resins, is impossible without patent infringement. Work is progressing on a simple method to obtain this end. The results, to date, have been gratifying.

COLLAPSE THERAPY OF PULMONARY TUBERCULOSIS [1]

THE ADVANTAGE OF HELIUM AS A SUBSTITUTE FOR AIR IN ARTIFICIAL PNEUMOPERITONEUM

A PRELIMINARY REPORT

By Lieutenant Commander E. Ricen, Medical Corps, United States Navy

The necessity for refills at comparatively short intervals in the collapse therapy of pulmonary tuberculosis is an obstacle which has been most difficult to overcome. The advantage of using a gas which would prolong the time interval between air injections into the pleural and peritoneal cavities is, of course, obvious. The average patient probably never reaches the point when he enjoys his regular injections of air via the needle. The prolongation of this interval between treatments, by the substitution of another gas, would be as much of a boon to the tuberculosis patient as protamine zinc insulin has been to the diabetic.

The speed with which gases disappear from body cavities is based on certain fundamental biophysical laws. It is proportionate to their solubility coefficients, diffusion speed and to their chemical affinities for substances dissolved in the blood.

The gas helium, because of its low solubility coefficient in water and in oil compared to the coefficients for nitrogen, recommends itself as a substitute for air. According to Behnke and Yarbrough (3), the solubility coefficients for helium in water and in oil compared to nitrogen is in the ratio of 2 to 3 for water and 1 to 4.5 for oil. They further state that the decreased solubility of helium in fat compared with nitrogen should decrease the elimination time of helium from the body. Another factor in the slower absorption of helium compared to air is the oxygen component of air. Oxygen is absorbed much more rapidly than either of the inert gases helium or nitrogen. Henderson and Henderson (6) have summarized the factors concerned in the mechanism that underlies the absorption of gas from any closed space in the body. The difference between gas pressures in an artificially produced air filled space and in the blood is the force of absorption; blood pressure and the hydrostatic pressure in blood vessels play no part in this mechanism.

Gases also disappear from body cavities by diffusion as well as by absorption. The pleura and peritoneum are membranes through which gases diffuse according to physical laws. Helium has a density oneseventh that of nitrogen and one-eighth that of oxygen. The molecular weight of these gases are helium 4, nitrogen 28 and oxygen 32. The diffusibility of a gas is directly proportional to the square root of its

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density. Thus by diffusion helium disappears more rapidly from body cavities than does air. Therefore, the advantage of helium in regard to slower absorption rate would appear to be nullified by its more rapid rate of diffusion.

In regard to the chemical affinity for substances dissolved in the blood the advantage lies with helium. Helium being an inert element does not enter into chemical combination with blood substances. The oxygen content of air readily combines with the various blood elements. Oxygen unites with the hemoglobin of the blood to form oxyhemoglobin. Consequently from purely a theoretical consideration, because of its lower solubility coefficient, slower rate of absorption and its total lack of affinity for blood constituents, helium should tend to disappear from body cavities more slowly than air. Whether or not these factors outweigh the disadvantage of the more rapid rate of diffusion of helium through body membranes could of course be determined experimentally.

The peritoneal cavity was selected to study the speed of disappearance of helium as compared to air. The peritoneal cavity offered certain advantages over the pleural cavity for conducting this investigation. Gas injected into the peritoneal cavity almost immediately collects under the diaphragmatic leaves and is readily visualized with the aid of the fluoroscope. The gradual disappearance of the gas can be followed by daily fluoroscopic examinations until it has completely disappeared. In the pleural cavity the problem is more difficult. The lung continues to remain collapsed for a considerable period of time after a constant gas mixture has been established within the pleural cavity. Furthermore, observing the interval necessary for complete expansion, would involve the risk of failure to recollapse the lung. The approach to this problem using the peritoneal cavity to measure the absorption of gases rather than the pleural cavity obviously entails fewer obstacles and is reasonably accurate.

A series of cases of pulmonary tuberculosis with previous phrenic nerve paralysis, supplemented by pneumoperitoneum were selected for the study. These cases had all been receiving weekly injections of 1,000 cc. of air into the peritoneal cavity. Before attempting the investigation, all air in the peritoneal cavity was allowed to completely disappear. This fact was verified by daily examination until air under the diaphragmatic leaves was no longer present. The time interval required for complete disappearance was noted. This procedure was then repeated using helium. Again the time interval necessary for complete disappearance of helium was recorded. In all instances a longer period of time was required for the disappearance of 1,000 cc. of helium from the peritoneal cavity than for an equal

FIGURE 1.—ONE WEEK FOLLOWING INJECTION OF 1,000 CC. OF AIR.
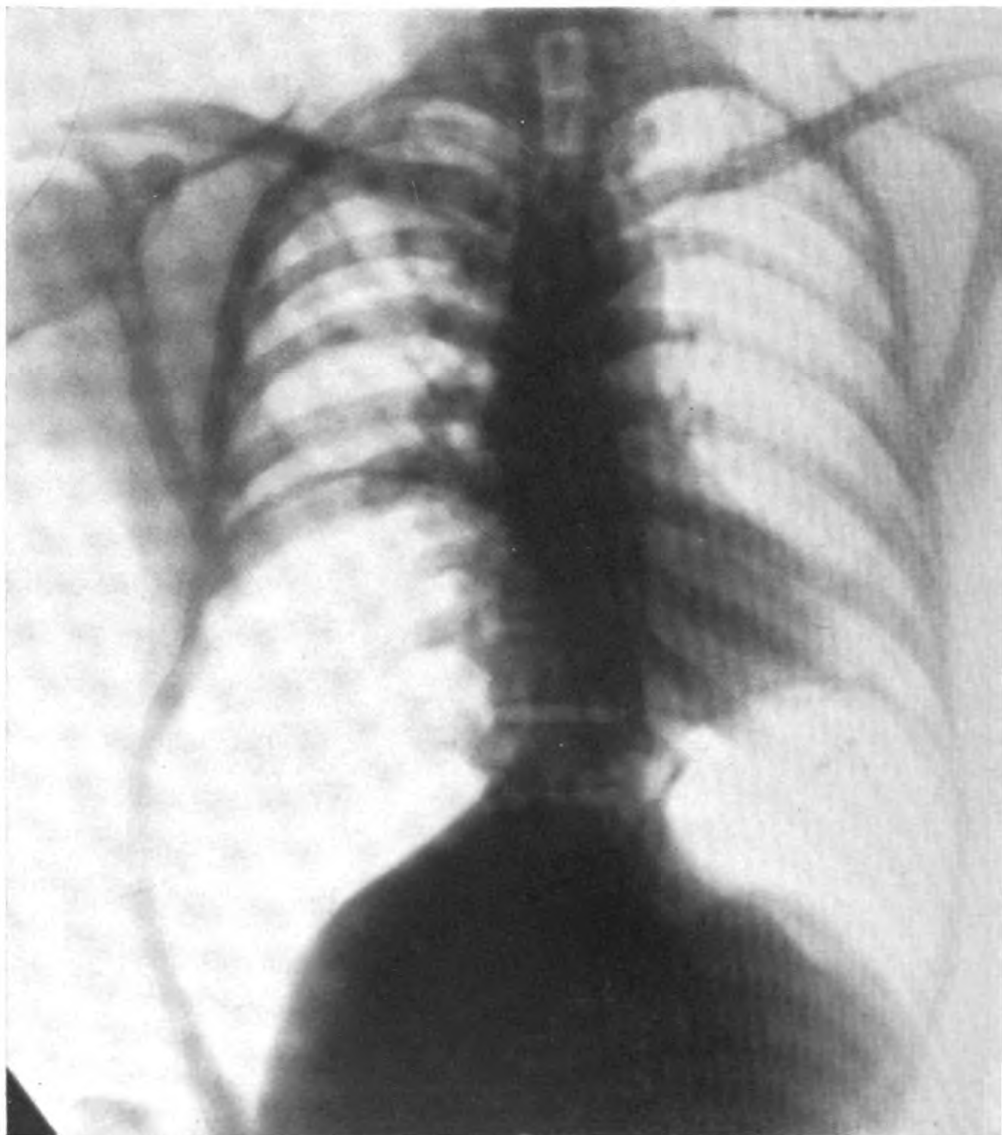
FIGURE 2.—ONE WEEK FOLLOWING INJECTION OF 1,000 CC. OF HELIUM.

amount of air. Figure 1 shows the amount of air remaining in peritoneal cavity 1 week following injection of 1,000 cc. of air. Figure 2 shows the amount of helium remaining 1 week following the injection of a similar amount of helium.

Table 1 reveals that from 4 to 6 days longer were required for the complete disappearance of 1,000 cc. of helium from the peritoneal cavity than for an equal quantity of air. Whether or not similar results

TABLE 1.—*Time for complete disappearance*

	Air	Helium		Air	Helium
	Days	*Days*		*Days*	*Days*
Case 1	8	12	Case 4	9	14
Case 2	11	17	Case 5	10	16
Case 3	7	12	Case 6	9	15

could be obtained in the pleural cavity will of course have to be determined by further study. A report of this study will be made in a future publication. The results of this study although not startling are nevertheless promising. If the interval between injections can be increased from 4 to 6 days, in the course of a year considerably fewer injections would have to be tolerated by the patient. In all cases helium was well tolerated in the peritoneal cavity.

CONCLUSION

1. Helium disappears from the peritoneal cavity more slowly than air.

2. Helium is well tolerated in the peritoneal cavity.

3. Helium offers definite possibilities as a substitute for air in the collapse therapy of pulmonary tuberculosis.

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THE ELECTROENCEPHALOGRAM IN NEUROLOGICAL DIAGNOSIS [1][2][3]

By Captain F. L. McDaniel, Medical Corps, United States Navy; Commander C. G. Hines, Medical Corps, United States Navy; Lieutenant Dana L. Farnsworth, Medical Corps, United States Naval Reserve; and Joseph Hughes, Director of Laboratories, Institute of Pennsylvania Hospital, Philadelphia, Pa.

The electroencephalogram (EEG) has become recognized as a useful and reliable aid in neurological diagnosis. Interest in this type of examination was stimulated by Berger's (1) announcement in 1933 that brain tumors set up abnormal electrical activity in the cortex which could be picked up by electrodes placed on the scalp of the patient. In 1935 the clinical usefulness of the electroencephalogram became apparent with the publication of Foerster and Altenburger's (2) work confirming Berger's observation. In the same year Gibbs, Davis and Lennox (3) reported the EEG findings in epilepsy and Walter (4) reported on the successful localization of cortical tumors by this type of examination. Shortly afterwards Jasper, Solomon and Bradley (5) reported on their findings of electrical responses typical of encephalitis in children with behavior problems. Since then numerous papers have appeared on the EEG findings related to neurological conditions. It should be noted here that while the EEG findings are positive in organic lesions they offer no help in the diagnosis of functional psychotic states such as in the affective psychoses or schizophrenia (6).

The electroencephalograph is an instrument capable of recording electrical potentials of the magnitude of millionths of a volt (microvolts). It makes use of high-gain vacuum tubes to amplify the brain potentials and a recording system to trace them. This instrument is approximately 1,000 times more sensitive than the electrocardiograph. The technic of recording an EEG is somewhat similar and no more inconveniencing to a patient than the taking of an EKG. The test is run with the patient sitting or lying down. After the electrodes are placed on the scalp, the potentials from each skull area are led into a specific amplifying channel so that simultaneous tracings can be obtained from each of the cortical areas being examined. For routine study at least two recording channels should be used; for the localization of focal lesions, an instrument which has three recording channels is preferable.

The interpretation of the electroencephalogram depends on the frequency and amplitude (voltage) of the potentials. Generally speaking, a normal EEG is one in which the potentials have a frequency

greater than 8 per second and an amplitude varying from 10 to 30 microvolts. An abnormal EEG is one in which the potentials are slower in their frequency (2 to 7 per second) and greater in their amplitude (50 to 200 microvolts). From a clinical viewpoint the cerebral potentials may be viewed as arising for the most part from the electrical activity of the ganglion cells in the gray matter of the cortex, they may be considered to be the electrical sign of activity of both the cell bodies (cell potentials) and of the cell processes (spike potentials). The slow frequency and increased voltage seen in the abnormal EEG has been explained by Hughes (6) as being due to the synchronization in the charging and discharging of large groups of cells as the result of the abnormal irritation of the nerve cells in the gray matter resulting from the pathological lesion.

Tumors or other space-taking lesions are electrically silent. The focal discharge of large slow waves seen in these lesions arise from the surrounding zone of irritated gray matter. Tumors may be localized accurately in 90 percent of cases if they involve the superior or lateral aspects of the cerebral cortex. With subcortical lesions the accuracy is less. The EEG is not accurate in detecting lesions on the floor of the anterior or middle fossae or those located in the posterior fossa unless there is involvement of the overlying cortex by pressure. In the field of tumor diagnosis the EEG offers the greatest clinical help in its ability to localize those frontal lobe lesions which fail to give focal neurological signs. The electrical findings noted previously for tumors can be taken as typical for all space taking lesions. Epilepsy may show a characteristic spike wave formation just preceding a seizure; more frequently it shows the presence of large slow waves, 3 to 6 per second in frequency, throughout both hemispheres. In some instances a single trigger area may be found. These abnormal findings may disappear after a convulsive seizure. In mild cases it may, likewise, be masked by sedatives. Meningitis and encephalitis give generalized abnormal findings. In this connection it is appropriate to state that all the EEG can do is to record a disturbance in electrical activity and to indicate whether the process is localized or involves the entire cortex. The nature of the underlying pathology must be interpreted from the clinical findings.

During the last 6 months at the Philadelphia Naval Hospital, 71 electroencephalograms have been made on 60 patients. The only criterion for selection was that all cases were done in which the procedure seemed to promise help in diagnosis. These cases are discussed by groups, and a type case of each group with its EEG tracing is presented.

Fourteen patients who had histories characteristic of idiopathic epilepsy were tested. Of this number, 11 had abnormal tracings characteristic of this disorder while 2 had normal tracings, giving a percentage

of 78 percent accuracy. One of the cases showing a normal tracing had a long history of what appeared to be typical convulsive seizures but during 5 weeks of observation in the hospital he had no seizures. Another had a history of frequent seizures while partially intoxicated, but during his numerous periods of hospitalization he had no seizure. The third had had 2 seizures, but both occurred after a moderate intake of alcohol.

<div align="center">CASE REPORTS</div>

<div align="center">CASE 1</div>

History.—H. M. M., U. S. Navy, age 26, was admitted on May 9, 1941 for observation of convulsive seizures. Good health had prevailed until 3 days before admission when he suddenly felt nauseated and had a seizure. He fell unconscious to the floor and had clonic and tonic contractions. Recovery was complete in about 10 minutes. No injury, tongue biting or sphincter relaxation occurred. A similar seizure occurred 2 days later. He complained only of persisting drowsiness on admission the following day. A previous episode, marked by sudden nausea and a period of unconsciousness was noted in 1937. No diagnosis was established during hospitalization at that time, and he was restored to duty under observation. Other episodes were denied. There was no past history of serious illness or injury, emotional instability, or adjustment difficulties.

Examination.—Physical and neurological findings were essentially negative. No abnormality of the fundus, visual fields, or pupils was noted. Urinalyses, blood picture, sedimentation index, basal metabolic rate, and Kahn reaction were normal.

Spinal fluid.—Clear, colorless; pressure and Queckenstedt normal, Kahn negative, no increase in globulin, total protein 30, gold curve negative, sugar 64 mg.

Pneumoencephalogram.—Emesis occurred after withdrawal of 73 cc. of spinal fluid and injection of 60 cc. of oxygen and the procedure was discontinued.

Roentgen examination.—The lateral ventricles were well filled and air was present in the third ventricle, but the cortical pathways were incompletely filled. No displacement, distortion or space taking lesion was evidenced. A mild degree of atrophy in the occipital region was suggested. Skull plates revealed no evidence of increase in intracranial pressure or pineal or sella turcica variation.

EEG.—Three tests were made. Slow abnormal waves were found in the left frontal lobe on the first tracing. These ranged from 2 to 3 per second in rate and average 100 microvolts. In the second and third tests these were repeated in showers in both frontal lobes. The evidence from the 3 tests favors an epileptic type of disorder with the frontal lobes being the area of greatest irritability (see fig. 1). The prognosis was considered to be poor.

Diagnosis.—Epilepsy, grand mal.

Progress.—The patient remained asymptomatic and made a good hospital adjustment. The diagnosis of epilepsy was established and he was invalided from the Service on August 26, 1941.

There were 8 patients who had suffered severe intracranial injuries causing loss of consciousness, including 3 with skull fractures, and the tracings of these patients were abnormal in each instance. One of them later had a pneumoencephalogram which demonstrated a space-taking lesion in the right frontoparietal area, in the same area as the

maximum disturbance exhibited by the electroencephalogram. The symptoms presented by the patient disappeared when the pneumoencephalogram was done so he refused operation and has remained symptomless to date (5 months at the date of writing). Another patient who had large abnormal waves in the left frontoparietal area 3 months after a skull fracture exactly opposite, had a negative tracing 3 weeks later. Electrical recovery was about 6 weeks later than clinical recovery in this instance. Another patient who was struck on the head by a falling ashcan had showers of 4 to 6 per second waves with 10 to 30 microvolts amplitude 4 weeks after the injury, and in 3 subsequent examinations over a 3-month period their number and frequency have steadily diminished.
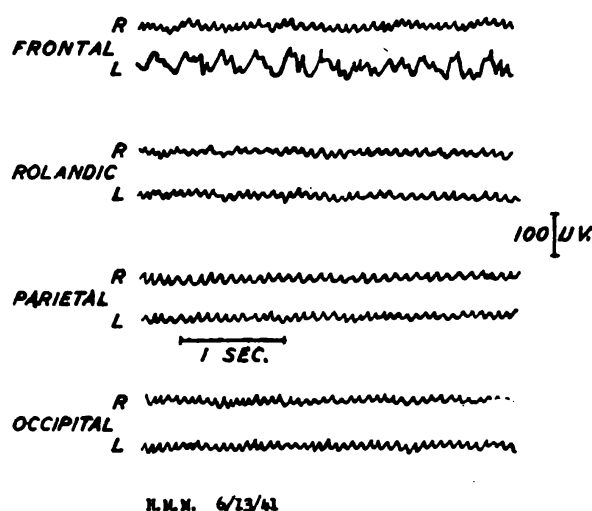
FIGURE 1.—Abnormal waves present in left frontal area. Clinical diagnosis. Epilepsy.

CASE 2

History.—H. W., age 19 years, was admitted June 14, 1941 for treatment of intracranial injury. He was in usual good health until 17 days before admission when he received a glancing blow on the left side of the head from a falling garbage can which rendered him unconscious for a few minutes. He noticed a dull headache shortly afterward, but the following morning he had a severe headache with some blurring of vision, and he felt as if he had a "hang-over." On June 29, 1941, at 1:15 a. m. he was lying quietly asleep in bed, on his abdomen, when he jumped up suddenly and dived over the head of the bed, striking it and breaking a pane in a nearby window, but suffered only a small laceration of his scalp. Headache recurred intermittently, most marked at night, for 2 weeks, then disappeared, and he was discharged to duty, symptom free, July 7, 1941. However, after 3 days he returned to the hospital with a report from his medical officer that he had fallen from his bunk twice the first night back on his ship, upset furniture, and awakened the men in his compartment, and that he appeared dazed, confused, and very emotional. He had another sleep-walking episode August 27, 1941. His past history was irrelevant except that he had suffered a

blow on the head while playing football 9 months before entry, with unconscious-
ness for a few minutes and headache for 2 days.

Examination.—Neurological examination was negative except for hypoactive
tendon reflexes and dilated pupils, the left slightly larger than the right. Blood
counts, urinalysis, sedimentation rate, and blood Kahn were normal. Skull
plates revealed no fracture.

Spinal fluid.—Clear and colorless; pressure and Queckenstedt normal; cell
count, 3; globulin, no increase; colloidal gold curve 0011000000.

EEG.—He has had four EEG's made on June 27, 1941, July 25, 1941, September
12, 1941, and September 19, 1941. In the first tracing there were showers of
abnormal waves seen in both hemispheres, ranging from 4 to 6 per second in
rate and 10 to 30 microvolts in amplitude (figure 2). These have decreased in
frequency and in the last tracing considerable improvement is shown.

Diagnosis.—Intracranial injury.

Progress.—He is still under treatment in the hospital.

Only 3 cases of brain tumor suspects occur in our series. In one
of these the clinical findings were not localizing in nature and the EEG
likewise had no localizing feature, although occasional abnormal waves
were seen in both temporoparietal regions. This patient has not as
yet had surgical treatment. Another patient had large, slow, abnormal
3 per second, 100-microvolt waves in the right temporal, frontal, and
parietal regions, a finding corroborated by clinical history and exam-
ination, and caloric studies on the vestibular apparatus. More pre-
cise localization awaits the results of ventriculography. The third
patient is reported here.
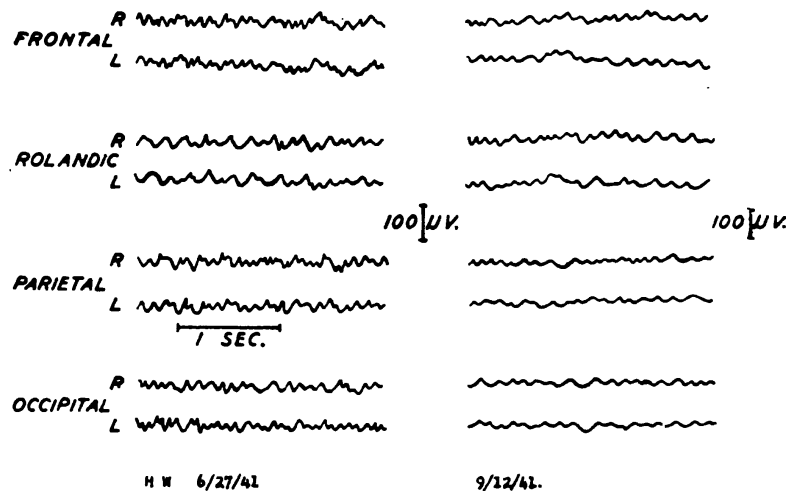
FIGURE 2.—*Left Column.* EEG 1 month after head trauma. Abnormal waves
present in both hemispheres. *Right Column.* EEG 2½ months later. Abnormal
waves still present but decreased in voltage.

CASE 3

History.—R. J. F., age 46 years, was admitted June 9, 1941 for observation for
possible cerebral tumor. A persistent, dull, occipital headache that failed to
respond to the usual anodynes and a nearly constant sensation of pressure above
the eyeballs, associated with blurring of vision, had been present for about 6 weeks.
About a month ago he began to have periods of vertigo with impaired vision,

when he would stagger and walk into objects. Previous health had always been quite good. There was no history of cranial trauma or of serious illness in child-hood except when a tracheotomy was performed during diphtheria. Adjustment had been very satisfactory.

Physical examination.—A well developed and nourished, middle aged white male. Temperature normal. Pulse 88. Blood pressure 120/90. Slight enlargement of heart to left by percussion. Tenderness on pressure over both eyeballs.

Neurological examination.—Cranial nerves, 2. Pupils sluggish to light and accommodation. Vision O. D. 18/20, O. S. 18/20. Fundus, 3 diopters of choking in O. D. and about 3½ diopters in O. S. Visual fields, left homonymous hemi-anopsia. Slight left facial weakness 2, 3, 4, 5, 6, 8, 9, 10, 11, 12 normal. Motor system: Gait slow and with caution, placing each foot carefully and moving eyes ahead and to the floor repeatedly. Slight intention tremor of left hand. Nutri-tion, tone, strength, paralyses, abnormal movements, and speech unaffected. Coordination: Romberg, negative; slight awkwardness in movements of left hand. Sensory system: touch, temperature, superficial and deep pain, position, vibration, and stereognosis normal. Peripheral nerves, normal. Reflexes: The abdominals were diminished on the left. A slightly positive Hoffmann was present on the right. No variation was noted in other reflexes.

FRONTAL

ROLANDIC

100 [U V.

PARIETAL

1 SEC.

OCCIPITAL

R.J.P. 6/13/41.
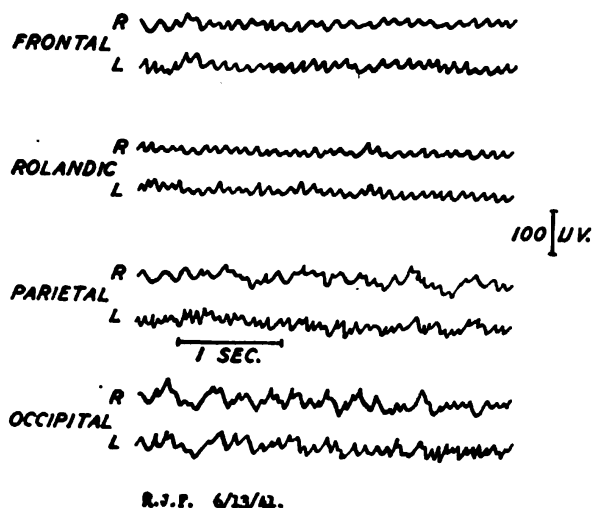
FIGURE 3.—Abnormal waves right parieto-occipital area. Sarcoma right parietal region.

Mental status.—Neat and tidy; was courteous, cooperative, and interested. Stream of talk was spontaneous, coherent, and relevant. No affective swing exhibited. Orientation complete. No psychotic trends elicited. Intelligence was above average.

Laboratory findings.—Urinalyses negative. Blood picture normal. Sedimenta-tion index, 16 mm. in 60 minutes. Kahn reaction negative. Spinal fluid: Pressure 330. No fluid was withdrawn.

Roentgen examination.—No bone pathology of the pelvis or femurs. No evi-dence of a metastatic lesion of the lungs. No intracranial calcification and no erosion of the sella turcica.

EEG.—There are slow abnormal waves, 100 microvolts in height, and 2 per second in rate, in the right parieto-occipital region (figure 3). Similar abnormal waves were also seen on the left. These are somewhat smaller in amplitude,

however. The electrical evidence favors a space-taking lesion involving the right parieto-occipital region with a possible spread to the left.

Diagnosis.—Tumor, intracranial, right parietal area.

Progress.—An extensive sarcoma of the right parietal area was found at operation, which was partially excised. Recovery from the operation was uneventful and the patient was discharged to the out-patient service on August 3, 1941.

Three patients had moderate or severe hypertension and their cortical tracings were definitely abnormal. Two of these had occasional convulsive seizures but these differed in character, clinically, from the seizures suffered by the idiopathic group.

CASE 4

History.—J. M., age 49 years, was admitted July 8, 1941, for investigation of fainting spells. He was in good health until 3 years before admission when he began to have attacks of dizziness and "fainting spells" which have recurred three or four times a month since then. He does not always lose consciousness in an attack, and can often avoid them by sitting or lying down for a few minutes. Buzzing in the left ear and numbness of the upper lip were frequent precursors of an attack. He sometimes bites his tongue, sometimes injures himself in falling, but never froths at the mouth or loses sphincter control. He came to the hospital because of contusions on his face suffered in a fall at the beginning of an attack.

For 10 years he had progressively increasing dyspnea on exertion, and recently had had several attacks of nocturnal dyspnea. His ankles were occasionally noted to be swollen, and on occasions he had experienced sharp, knifelike pains in the precordium, radiating down the left arm.

Examination.—His heart was slightly enlarged, there was a soft blowing systolic murmur heard at the apex, not transmitted, and the pulse rate was 100. Blood pressure 160/104. He had marked arteriosclerotic changes in the fundi, moderate concentric constriction of the visual fields, the left more than the right; slight right facial weakness; and hyperactive knee and ankle jerks. Blood counts, urinalysis, sedimentation rate, blood Kahn, blood sugar and serum calcium were all normal.

Spinal fluid.—Clear, colorless; pressure and Queckenstedt, normal; Kahn, negative; no increase in globulin; total protein, 40 mg.; gold curve, 1112000000; sugar, 60 mg.

Roentgen examination.—Skull: plates negative.

EEG.—There are scattered, abnormal sharp waves seen throughout both hemispheres (fig. 4). There is no electrical evidence for a focal lesion. The right premotor area is probably the most irritable.

Diagnosis.—Hypertensive encephalopathy.

Progress.—He remained in the hospital for 7 weeks and had no seizure during that time, although he had several attacks of dizziness which were aborted by lowering his head. He was discharged August 1, 1941, in fair condition.

A 51-year-old patient who had coronary heart disease and who presented the clinical picture of multiple sclerosis had poorly developed, very low voltage waves, but there were single sharp waves synchronous with the arterial pulse in all leads. This was the only case in our series which exhibited this phenomenon and its significance is not clear. Another case of multiple sclerosis in a 28-year old patient had occa-

sional sharp waves and showers of low voltage 3 to 8 per second waves. A case of unexplained cortical atrophy demonstrated by both pneumo- and electroencephalography follows:

CASE 5

History.—W. H. D., age 53 years, was admitted July 14, 1941 for diagnosis with special reference to diabetes and epilepsy. He has been taking white tablets for "fits" for years and has numerous certificates of physicians as to treatment for epileptiform seizures. Seizures recently have occurred at bimonthly intervals. These were characterized by unconsciousness, shaking of the left extremities, and usually urinary incontinence; absence of aura, tongue biting, or injury; occurrence in the evening, especially after retiring, and of 5 to 10 minutes duration. He has been attending an out-patient clinic since December 1937 for diabetes and
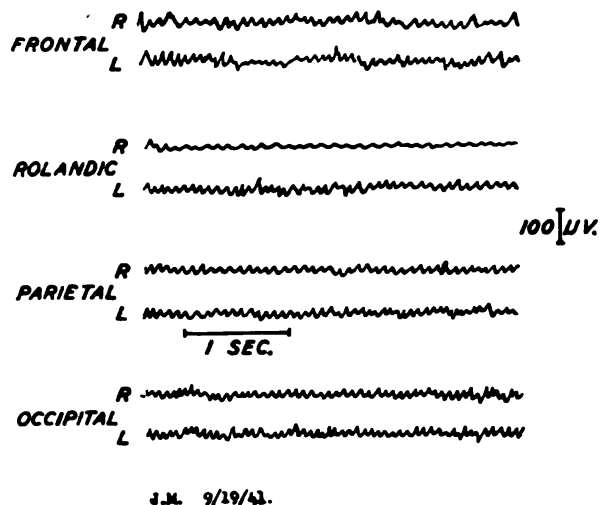
Figure 4.—Scattered abnormal sharp waves throughout both hemispheres. Clinical diagnosis. Hypertensive Encephalopathy.

has been on a diet of 2,015 calories. Weakness on the left side that has gradually increased since onset in 1937. Recently he found it necessary to use a cane in walking. He recalled a temporary hemiparesis following a period of unconsciousness in 1927. Chancroid in 1918. He has indulged in alcohol "for years."

Examination.—A well developed, fairly well nourished white male of middle age exhibiting no discomfort, cyanosis, jaundice, dyspnea or edema. Afebrile. Blood pressure 122/72. Height 5 feet 9 inch. Weight 142 pounds. Conjunctivae injected. Uses glasses for reading. Edentulous with upper denture only. Liver extends two fingers breadth below the costal margin. Benign enlargement of prostate.

Neurological.—Cranial nerves unaffected except for possible slight paresis of left face. Gait: Lagging of left leg with inward toeing. Coordination tests not well performed on left. Romberg negative. Adiadokokinesis present in left upper extremity. Rebound, nutrition, tone and pointing tests normal. Force considerably diminished in left extremities. Small amount of muscular atrophy of upper left leg. Sensory system: Touch, temperature, superficial and deep pain, position, vibration, stereognosis, and barognosis normal. Peripheral nerves: Volume, consistency, tenderness, irritability, Lasègue and Chvostek normal. Superficial and

deep reflexes were present and somewhat lively on the left. No pathological reflexes were present.

Mental status.—Essentially negative in appearance, behavior, stream of talk, emotional reaction, thought content, sensorium, perception and mental grasp and capacity.

Laboratory findings.—Blood picture normal. Urinalyses normal and negative for sugar, acetone and diacetic acid. Blood sugar, 76 and 84 mg. per 100 cc. Glucose tolerance normal. Kahn, blood reaction, negative. Sedimentation index, 7 mm. in 60 minutes.

Spinal fluid.—Pressure, normal. Queckenstedt, normal. Cell count, 1. Total protein, 10 mg. Kahn reaction, negative. Gold curve, 0000000000.

Pneumoencephalogram.—156 cc. of fluid removed and 170 cc. of oxygen injected. Moderate dilatation of both lateral ventricles, the right slightly larger than the left. The subarachnoid space in the right frontal and parietal areas was unduly prominent and widened in all directions due to moderately advanced atrophy of the cerebral cortex of the motor area. The brain was otherwise not remarkable.

EEG.—The cerebral potentials are diminished to an abnormal degree in both frontal and parietal lobes and to a lesser degree in both occipital lobes (fig. 5). Bilateral cortical atrophy is indicated. There is no evidence of any localized lesion.
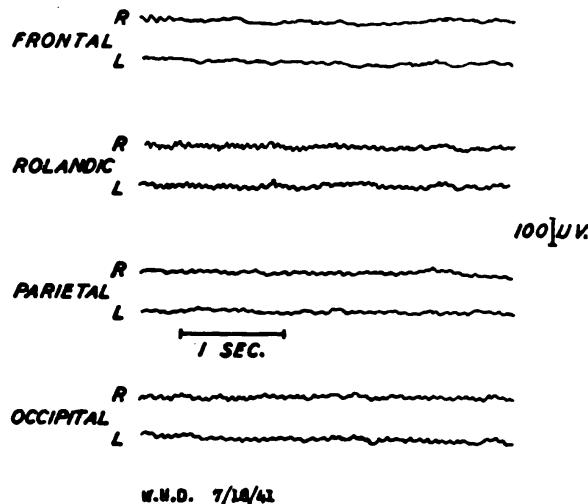
FIGURE 5.—Poorly developed cerebral potentials throughout both hemispheres. Clinical diagnosis. Cortical Atrophy.

Diagnosis.—Cortical atrophy, bilateral.

Progress.—No seizure occurred during hospitalization and symptoms continued unchanged. Observation was completed on August 14, 1941. He was discharged with the diagnosis of bilateral cortical atrophy, left hemiparesis and Jacksonian epilepsy by history.

Two cases are of considerable interest in that the EEG was markedly abnormal when other laboratory and clinical studies were negative. One man of 46 who had had two severe convulsions 5 years apart had negative studies including a pneumoencephalogram, but his EEG had showers of large abnormal waves in the right and left motor and parietal regions. In another case, with long continued headaches and psychic symptoms, there were abnormal potentials of low voltage and

4 per second rate in both frontal lobes, and which increased to over 200 microvolts in height with hyperventilation. Although no diagnosis has as yet been confirmed in either of these two, the EEG indicates that further study and observation is needed, and should help in avoiding the error of making a "functional" diagnosis.

Figure 6 illustrates the great increase in voltage after hyperventilation in the latter case referred to above.
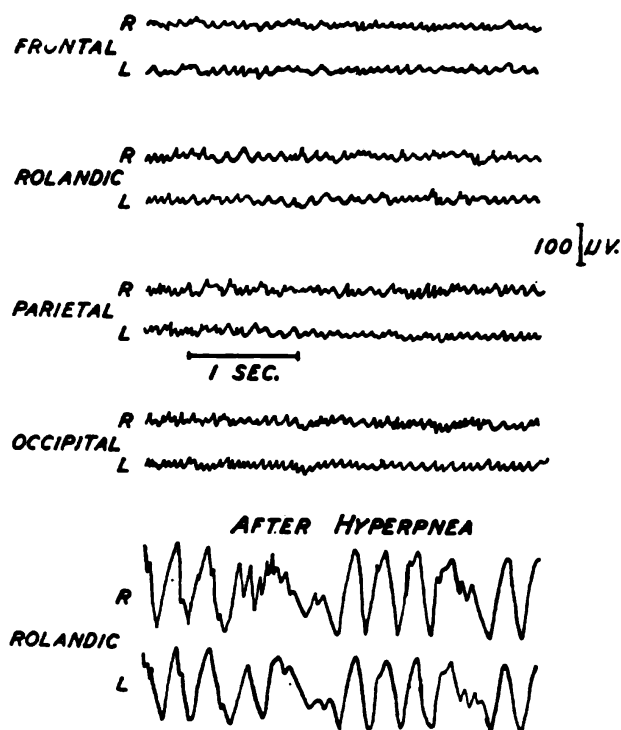
FIGURE 6.—Large abnormal waves seen following hyperpnea in a case of undiagnosed headache.

In five cases of old cerebral thrombosis or hemorrhage, abnormalities were noted in all but one.

Of the 24 negative tracings (22 patients), 14 were cases of psychoneuroses or constitutional psychopathic inferiority, 2 of chronic alcoholism, 1 intracranial arteriovenous aneurysm, 1 psychosis unclassified, 1 myopathy, 1 cerebral arteriosclerosis, 1 acute alcoholism followed by transient loss of consciousness with clonic movements, and 1 case of long continued headache as yet undiagnosed, but who has had 3 convulsive seizures under circumstances suggesting an intracranial lesion.

Abnormal waves of 100 to 200 microvolts in height and 3 to 5 per second in rate occurred throughout both hemispheres in a patient with metastasis to the brain from a carcinoma of the prostate. Lesser general abnormalities occurred in a case of brain abscess, and in a patient

who presented the clinical picture of an anxiety neurosis. Poorly developed, low voltage rhythms occurred in a case of neurosyphilis with positive serology and bilateral involvement of the eighth cranial nerve, and a case of systemic syphilis with negative serology in the spinal fluid.

DISCUSSION

The electroencephalogram is proving very useful in the routine study of neuropsychiatric cases in this hospital, and is, at least, as valuable to the neuropsychiatrist as the electrocardiogram is to the cardiologist. As Davis (7) has pointed out, it offers more promise because there are fewer opportunities for direct correlation of cortical function with the generation of electrical output than there is in the case of the heart's electrical output.

One of its main fields of usefulness is in the establishment of the diagnosis of epilepsy. It can displace the pneumoencephalogram in many instances because it gives information of a positive value whereas a normal pneumoencephalogram only helps in the elimination of "organic" factors.

It might eventually be used profitably in questionable cases of disturbance in consciousness when the person under consideration is up for reenlistment or even, at times, for the first enlistment. Those individuals who wish to enlist in the Navy and who are free of symptoms, but who have a family history of convulsive seizures might well be required to have an electroencephalogram made.

It is useful in the localization of tumors, in helping to rule out organic disease in psychotic or near psychotic patients who have many somatic complaints, in differentiating between organic and functional causation of obscure headaches as in the case illustrated by figure 6, and in estimating the degrees of recovery following intracranial trauma. Disturbance of consciousness due to hypertensive encephalopathy may be differentiated from idiopathic epilepsy.

It is still advisable to consider electroencephalography as an experimental procedure but its widespread use will soon clearly define its limits of usefulness and reliability.

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PERORAL ENDOSCOPY IN A NAVAL HOSPITAL [1]

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Peroral endoscopy is another important adjunct present-day medicine has to offer for diagnosis as well as treatment. This procedure includes laryngoscopy, bronchoscopy, and esophagoscopy. Gastroscopy must be included but it requires such expensive equipment and long training for the endoscopist, that it is not practical except in large specialized clinics.

In January 1941, at the United States Naval Hospital, Chelsea, Mass., a team was organized to make peroral endoscopic examinations. This team consisted of the endoscopist and three assistants, with the assistants assigned to carry out the following duties:

First assistant_____ To support and control the head of patient.
Second assistant (nurse)_____ To handle instruments.
Third assistant_____. To hold shoulders of patient firmly to table.

To assure accuracy and expert conduction of the examination, it is important that the operators perfect their technics so that, as a team, their work proceeds smoothly.

In order to effect the desired balance in team cooperation, considerable patience and exactitude is required of each member, especially in the case of the first assistant. While conducting the examination, there is great possibility of injuring the soft tissues, which may prove fatal, if the first assistant fails to properly adjust the position of the patient's head with each movement of the instrument.

Aseptic technic is observed.

Because of frequent changes in naval medical personnel, it is difficult to maintain a permanent team at a naval hospital. This difficulty can be overcome by maintaining a small reserve of trained personnel.

During the past 12 months, we have done 64 peroral endoscopic operations for diagnosis and therapy. Forty· of these were bronchoscopies, 16 esophagoscopies, and 8 laryngoscopies.

Bronchoscopies.—These were done for the following conditions: bronchiectasis, lung abscess, atelectasis, asthma, tumor, and foreign body. Other conditions in which excellent results can be obtained by

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bronchoscopy, both diagnostic and therapeutic are acute infective la-ryngotracheitis, impending asphyxia, hemoptysis, stenosis, and tuber-culosis. All bronchoscopies were done under local anesthesia.

Bronchiectasis.—This condition is more widespread than is generally realized. In frequency it stands second only to tuberculosis, among chronic infections of the lung. More of the endoscopic procedures were done for bronchiectasis than for any other disease. The thera-peutic value of this operation has been established, but treatment should be instituted early in the disease before too much pulmonary tissue has been destroyed, and cavitation established. Treatments may have to be done over a considerable period of time and at frequent intervals, depending on the progress of the case.

Our cases at this hospital have varied in degree of advancement, from the early stage of productive cough (fig. 1) to the advanced stage of cylindrical and saccular dilatation of the bronchi (fig. 2). In the latter stage it may be necessary to do a lobectomy.

Treatment consists of aspiration of the thick, viscid mucus and pus, applying adrenalin and cocaine to the walls of the bronchi and cavities, thereby establishing ventilation and drainage.

The condition existing in bronchiectasis is essentially that of a septic tank, and the end desired is to produce ventilation and drainage and reestablish normal mucous membrane with its cilia to sweep the secretions outward.

Atelectasis.—Bronchoscopy for this condition is dramatic in end results and should be considered an emergency as soon as the collapse is recognized. We have a bronchoscopist on call at all times for this condition. With immediate aspiration of the obstructed bronchus, considerable morbidity and, undoubtedly, some mortalities are pre-vented.

With an obstructed bronchus and collapsed lobe or entire lung, we have ideal conditions for the growth of organisms and a resultant pneumonia, or lung abscess, or even gangrene. Undoubtedly, many of the cases of postoperative pneumonia in the past have occurred as a result of unrecognized and untreated atelectasis.

Figures 3 and 4 show x-ray pictures of the chest before and after bronchoscopy for atelectasis of different types following operation under local anesthesia for chronic appendicitis and stone of the ureter on the left side.

Lung abscess.—Any lung abscess can be drained by aspiration through the bronchoscope unless it is in the extreme periphery of the lung. An abscess in the lower or middle lobes can be drained easily and when it is in the upper lobes the flexible curved aspirating tube can reach it. Figure 5 shows x-rays of the chest before and after bronchoscopic drainage of a large abscess of the right upper lobe.

PLATE 14
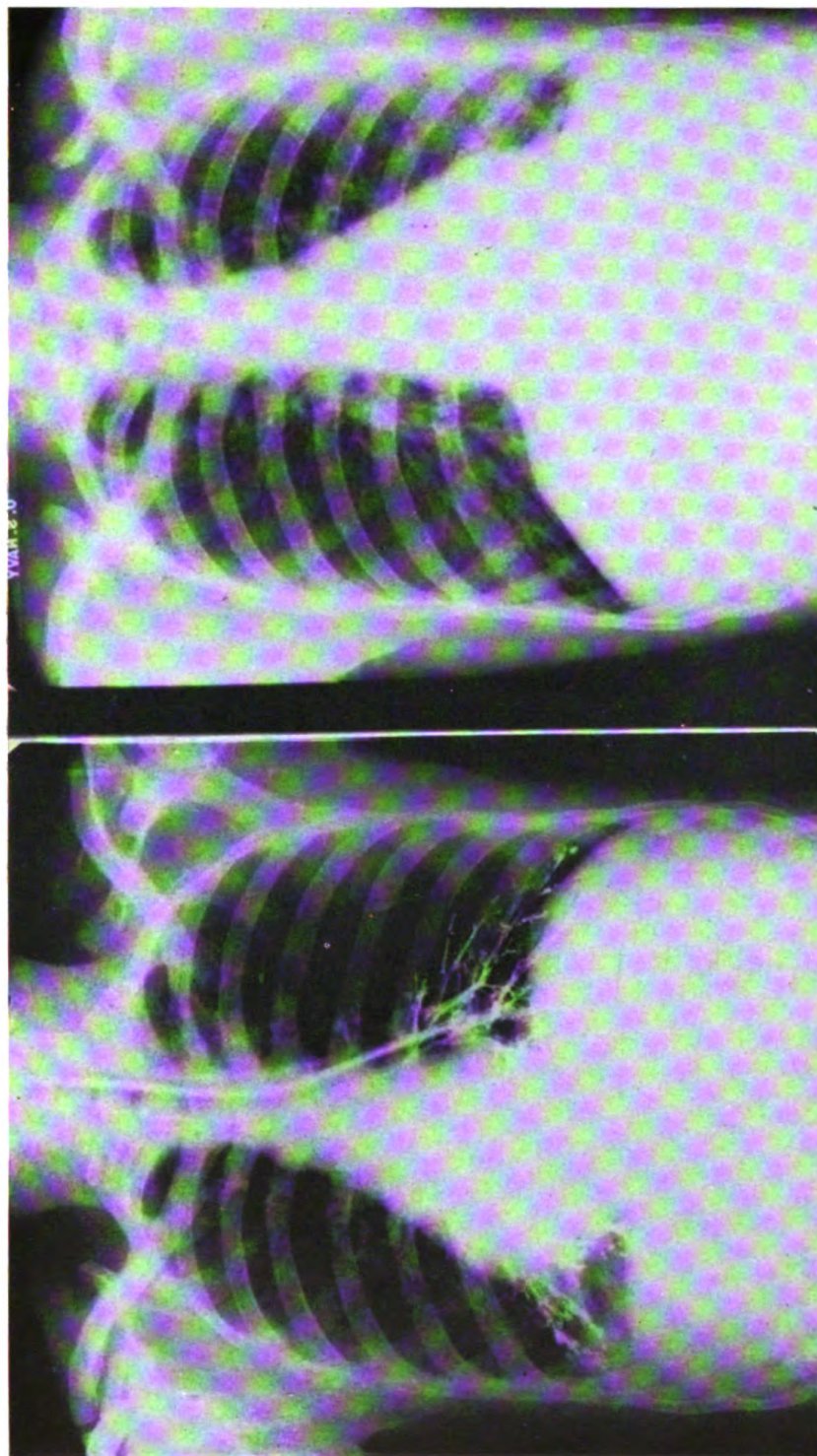
FIGURE 1.—(LEFT) LIPIODOL INJECTION SHOWING EARLY BRONCHIECTASIS BOTH LOWER LOBES. (RIGHT) PLAIN FILM SHOWING SAME THING AND PLEURISY OF LEFT LOWER LOBE.

PLATE 15
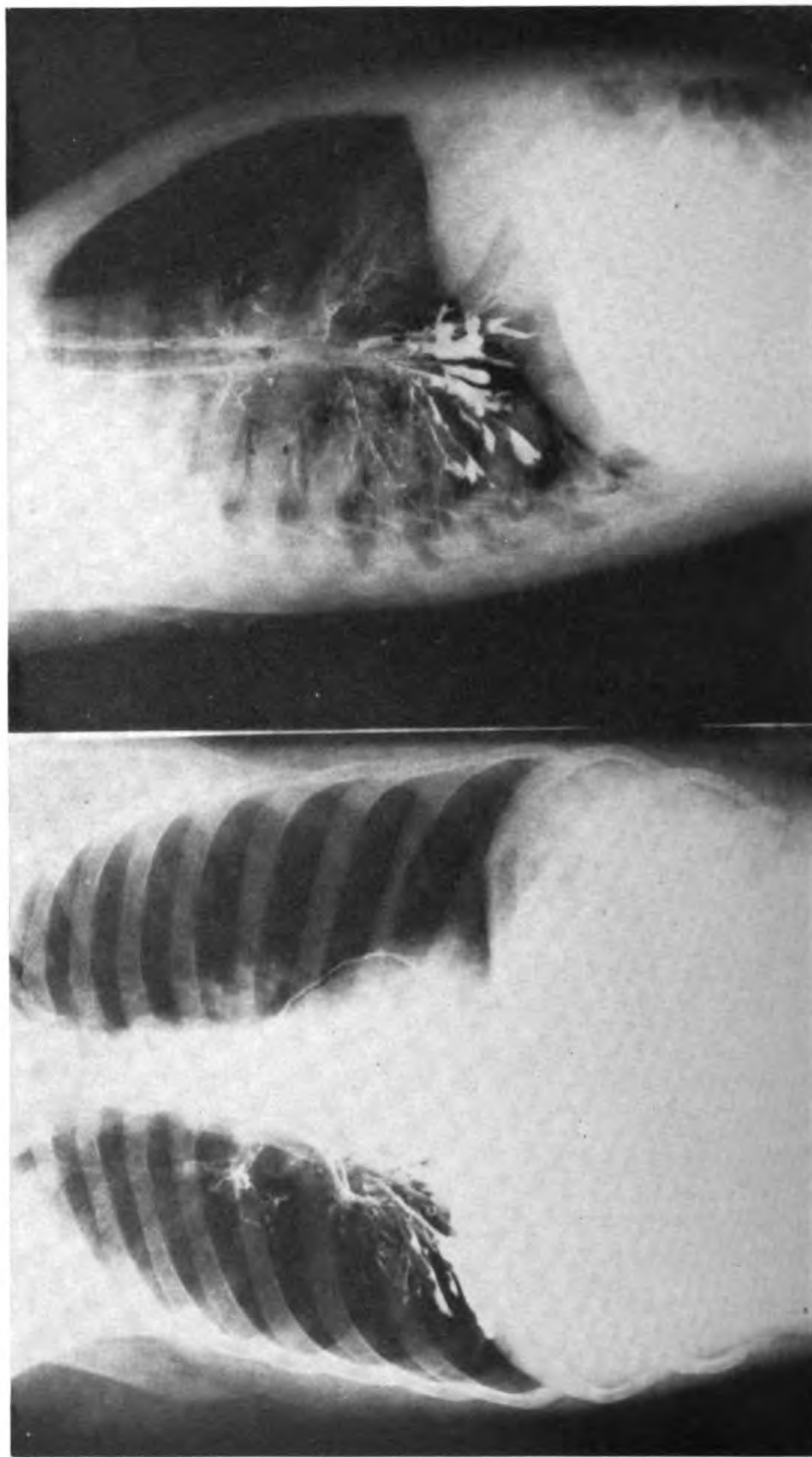
FIGURE 2.—LIPIODOL INJECTION SHOWING ADVANCED BRONCHIECTASIS OF THE RIGHT LOWER LOBE. CYLINDRICAL AND SACCULAR DILATATION OF THE BRONCHI. UNDER BRONCHOSCOPIC TREATMENT THIS MACHINIST'S MATE GAINED 15 POUNDS IN WEIGHT AND IS NOW ON DUTY WITH THE FLEET.

PLATE 16
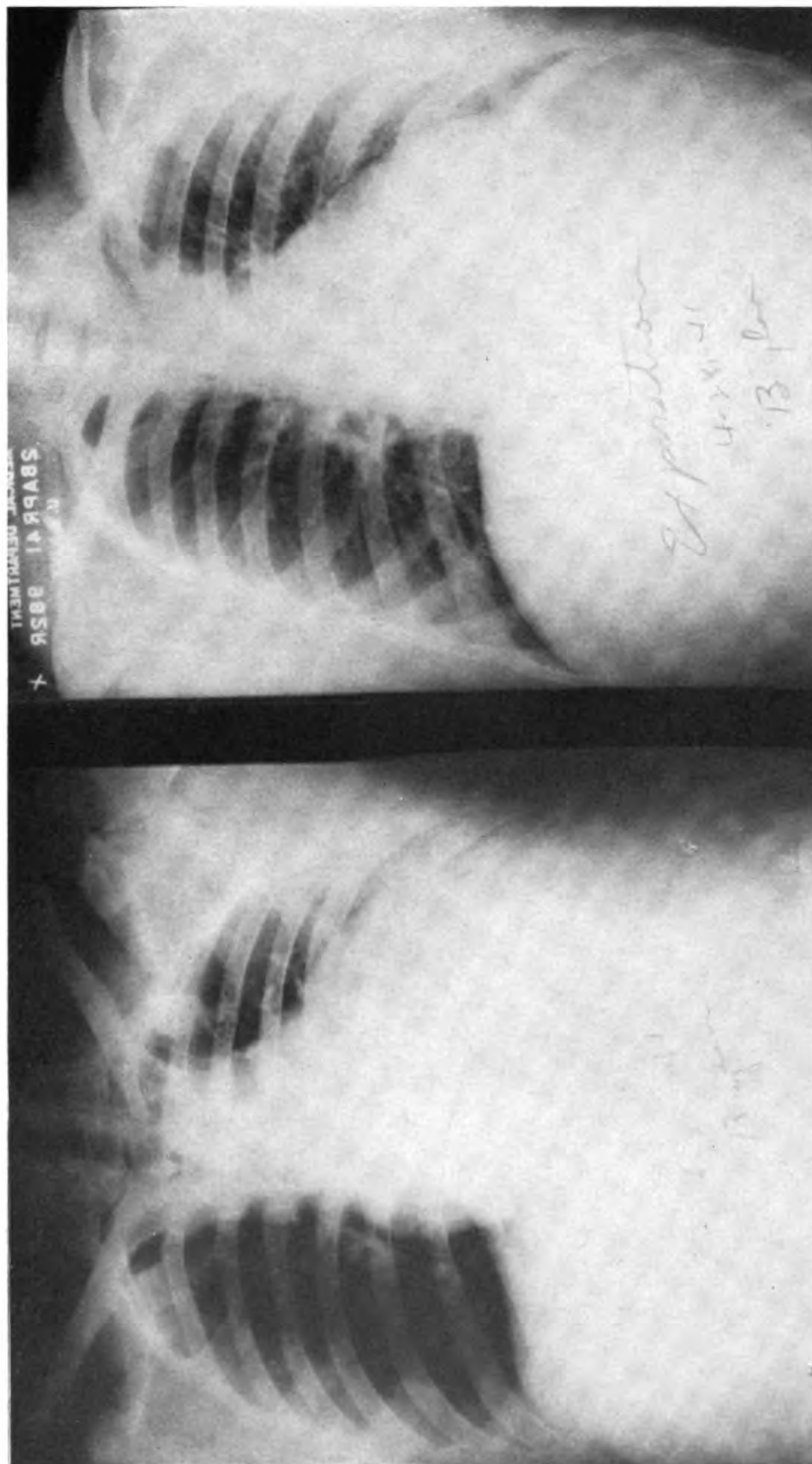
FIGURE 3.—(LEFT) CHEST PLATE SHOWING ATELECTASIS OF THE LEFT LOWER LOBE. THERE IS A SHIFT OF THE MEDIAS-
TINAL CONTENTS TO THE LEFT. THIS FOLLOWED APPENDECTOMY UNDER LOCAL ANESTHESIA. (RIGHT) AFTER
BRONCHOSCOPY SHOWING THE MEDIASTINAL CONTENTS IN THE MIDDLE AND AERATION OF THE LOWER LOBE.

PLATE 17
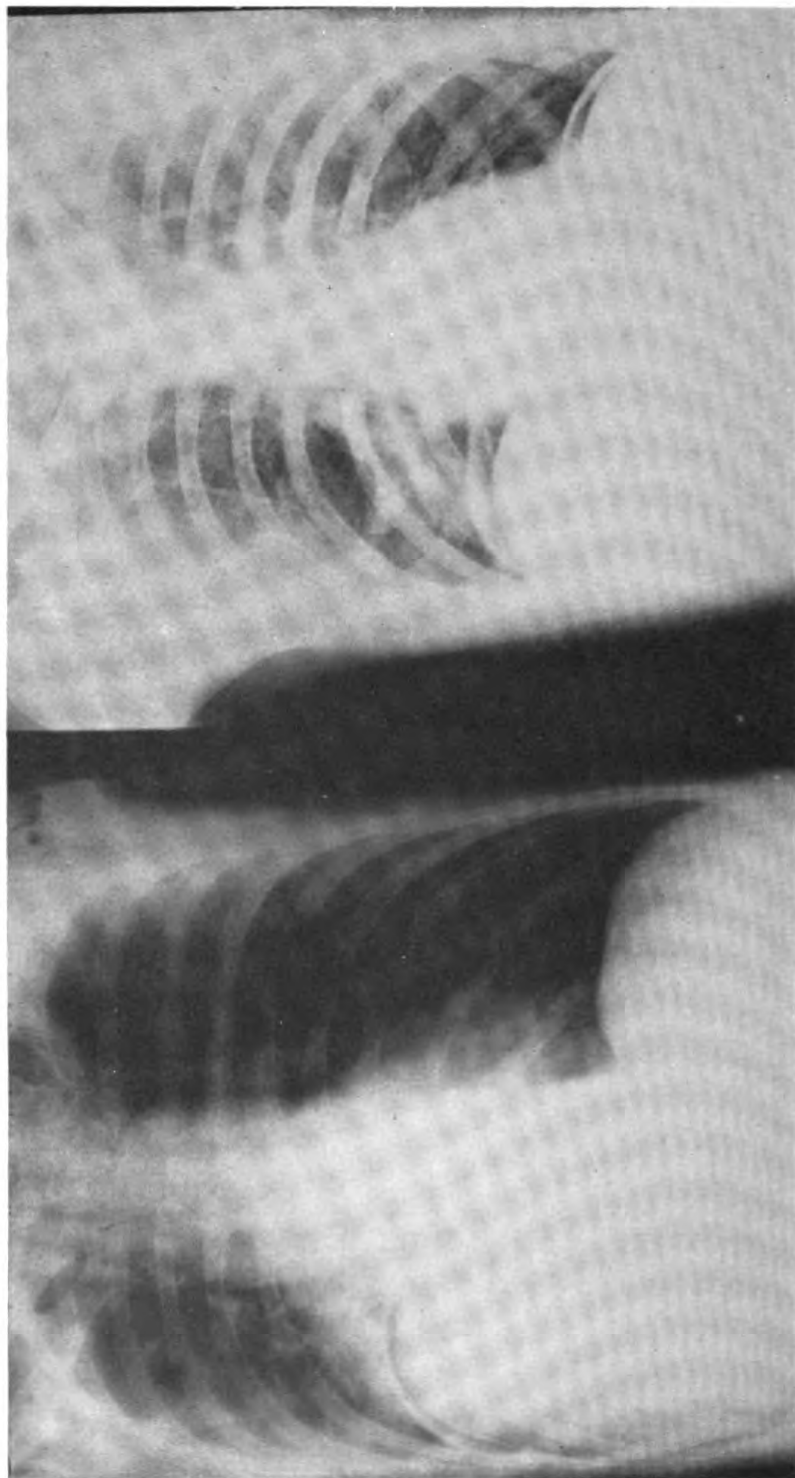
FIGURE 4.—(LEFT) ATELECTASIS OF THE RIGHT MIDDLE AND LOWER LOBES. THERE IS A SHIFT OF THE TRACHEA AND MEDIASTINAL CONTENTS TO THE RIGHT WITH MARKED ELEVATION OF THE DIAPHRAGM. EMPHYSEMA OF THE RIGHT UPPER LOBE AND THE LEFT LUNG. THIS FOLLOWED LEFT URETEROLITHOTOMY UNDER LOCAL ANESTHESIA. (RIGHT) CHEST PLATE IMMEDIATELY AFTER BRONCHOSCOPY, SHOWING AERATION OF ALL THE LOBES, A SHIFT OF THE MEDI-ASTINUM BACK TO THE CENTER, AND LOWERING OF THE DIAPHRAGM. THERE IS AIR UNDER THE DIAPHRAGM IN BOTH PLATES, WHICH GOT INTO THE PERITONEUM THROUGH THE OPERATIVE WOUND.

PLATE 18
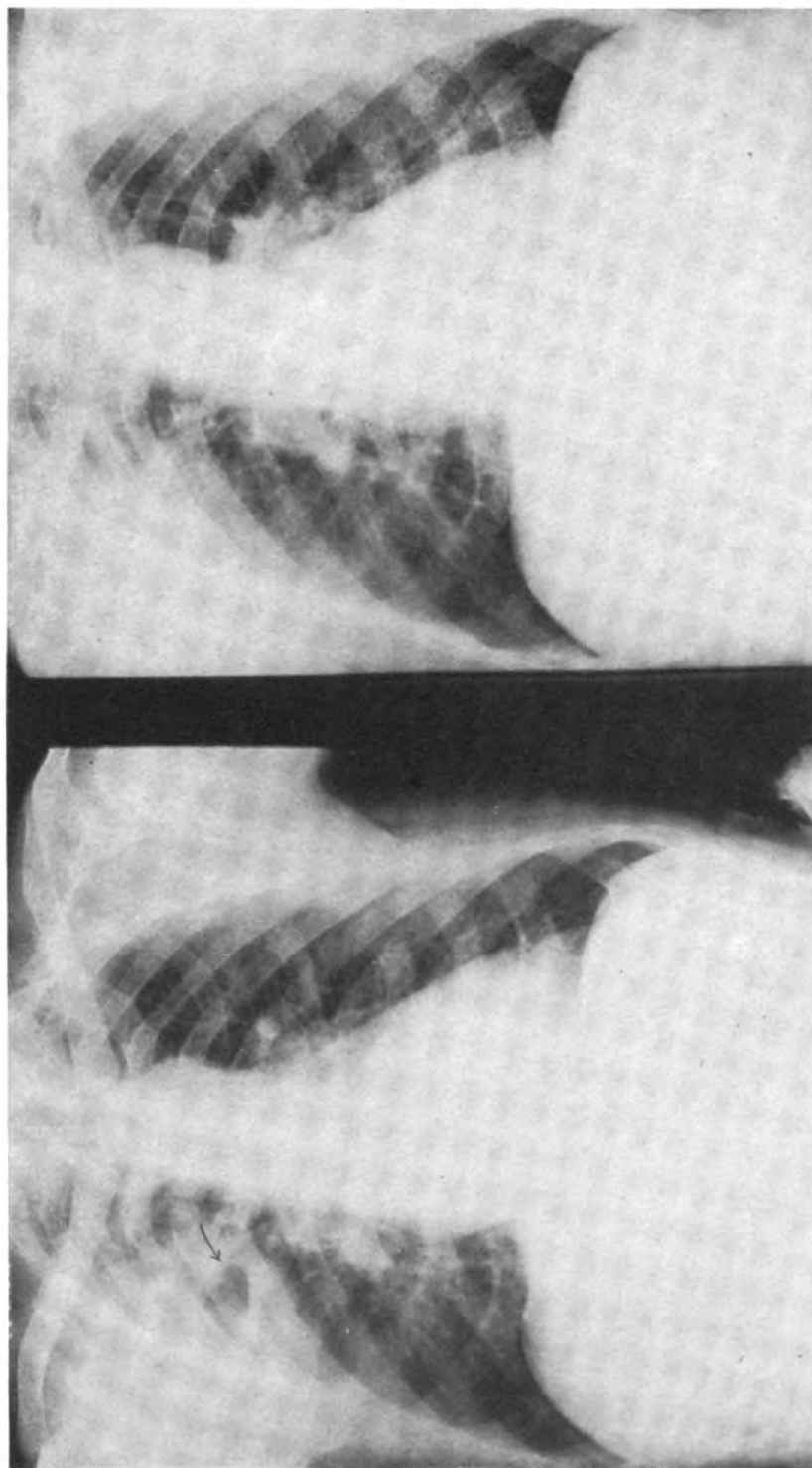
FIGURE 5.—(LEFT) LARGE ABSCESS SHOWING A FLUID LEVEL IN THE RIGHT UPPER LOBE (ARROW). (RIGHT) AFTER BRONCHOSCOPY AND ASPIRATION OF 2 OUNCES OF PUS.

PLATE 19
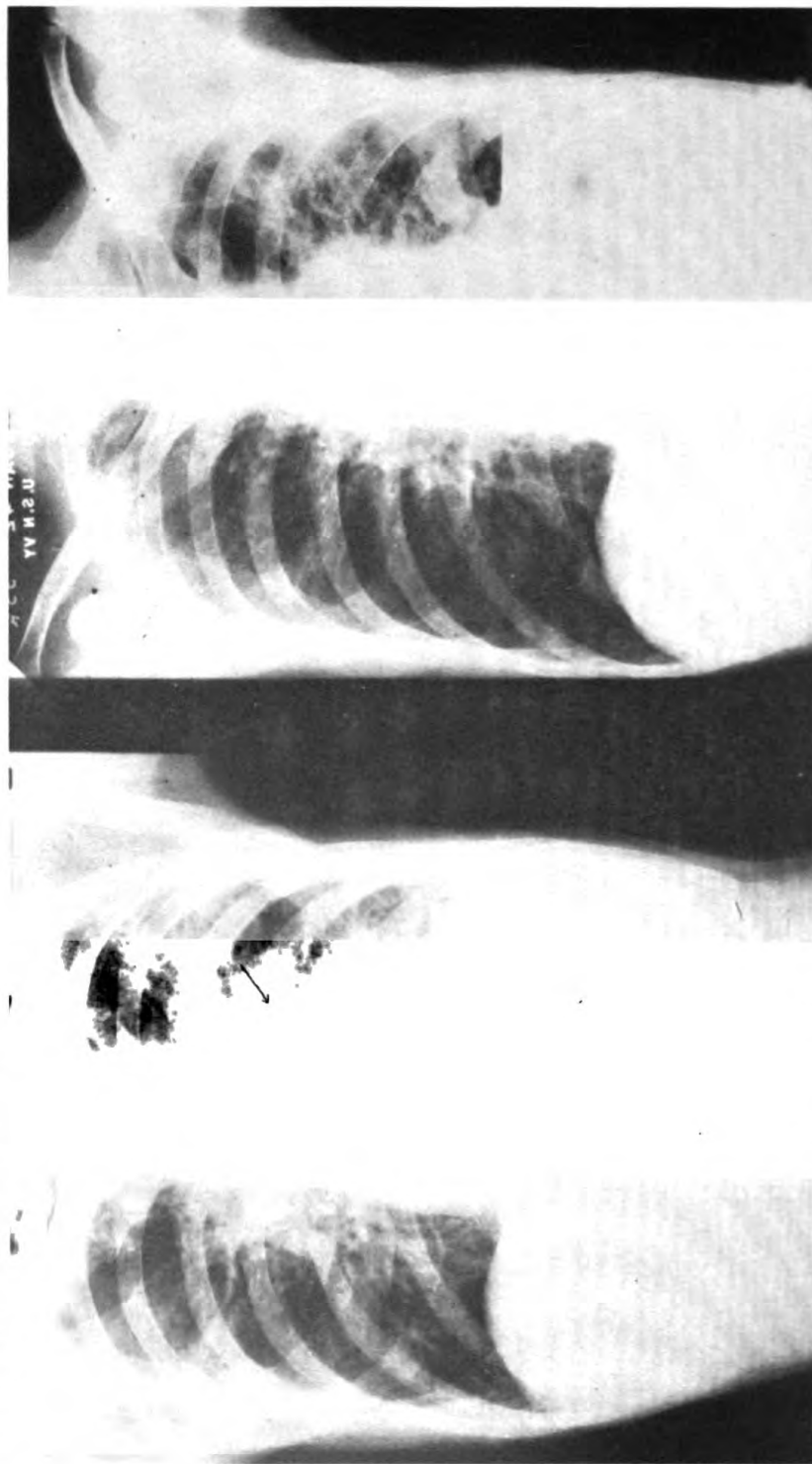
FIGURE 6.—(LEFT) ARROW POINTS TO FOREIGN BODY (CROWN OF A TOOTH) IN THE LEFT MAIN BRONCHUS. PRESENT 11 YEARS. THERE IS ALSO A LARGE ABSCESS WITH A FLUID LEVEL IN THE LEFT LOWER LOBE AND THICKENING AND SCARRING OF THE LEFT UPPER LOBE. (RIGHT) SHOWS THE ABSENCE OF THE FOREIGN BODY FOLLOWING BRONCHOSCOPY. THE ABSCESS HAS PARTLY FILLED AGAIN.

Tumors.—Bronchoscopy is indispensable for diagnosis of tumors of the bronchi and lungs if it is to be done early enough for effective surgery. It is imperative to have a thorough history and to do bronchoscopy and biopsy as soon as any symptoms are manifest, or if the diagnosis is in doubt (and it usually is). A biopsy is simple and will show the absence or presence of a tumor.

Asthma.—Bronchoscopy for asthma is therapeutic, and it must be done in conjunction with other treatment such as the administration of iodides to help liquify the mucus and promote glandular activity. Aspiration of the tough viscid secretions and application of adrenalin to the mucosa gives relief to the patient, especially in the paroxysmal type.

Foreign bodies.—If the foreign body is in the bronchial tree, it can be removed by bronchoscopy. If it remains, it may be encysted and become objectively inert for a long time, but eventually it is apt to cause abscess, or gangrene, and destruction of a lobe, or even the entire lung, depending on its location.

The ease with which a foreign body may be overlooked and remain comparatively symptomless for years is demonstrated in the case shown in figure 6. This is the crown of a tooth lodged in the left main bronchus of a retired C. P. O., 49 years of age. He aspirated this foreign body 11 years ago and gives a history of a chronic nonproductive cough until 3 months ago, at which time he caught a cold, and has had a severe productive cough and the loss of 30 pounds in weight since. At bronchoscopy, a large abscess in the left lower lobe (shown in the x-ray with a fluid level) was drained. The foreign body could not be found as it was imbedded in scar tissue and granulations, but it was loosened to such extent that he coughed it up, as it was not shown in subsequent x-rays.

Vegetable foreign bodies in the bronchial tree give the greatest immediate danger, especially the ubiquitous peanut because it contains arachic oil which is a violent irritant and very toxic to the pulmonary tissue.

Bronchoscopy is going to be of greater importance during and after this war, in helping the thoracic surgeon to diagnose, locate, and remove bomb fragments and shrapnel, and to treat their after effects.

Esophagoscopy.—Esophagoscopy is performed chiefly for diagnosis. If there is any outcropping or mass on the walls of the esophagus, a biopsy is taken for diagnosis. We had one case of carcinoma in the middle third of the esophagus, confirmed by biopsy.

The greatest care must be observed in manipulation of the esophagoscope and in the taking of biopsies, or perforation might occur causing mediastinitis and death.

Removing foreign bodies with sharp edges or points from the esophagus should be done on the fluoroscopic table and with the co-operation of the fluoroscopist in order to avoid a tear or perforation of the esophageal wall.

We have treated ulcers at the lower end of the esophagus by cauterization with 10 percent silver nitrate and strictures by dilatation with bougies. If the patient has a short thick neck it is better to have ether anesthesia, but all others can be esophagoscoped under local anesthesia.

Laryngoscopy.—Laryngoscopy can be done in all cases under local anesthesia and, sometimes, without any anesthesia. It is performed chiefly for diagnosis but many foreign bodies lodge in the pyriform sinuses and can be removed by direct view with the laryngoscope. Sometimes it is better to remove these foreign bodies without anesthesia, as during the application of the local anesthesia damage might be done by forcing a sharp point into the tissues, or dislodging it into the trachea.

We have also done laryngoscopy for the removal of polypus, papilloma, and prolapse of the laryngeal ventricle, as well as treatment by application of medication to the laryngeal structures and biopsy of tumors of the vocal cords and adnexa.

OSTEOMYELITIS OF THE MANDIBLE[1]

By Lieutenant Commander Frank H. Wanamaker, Medical Corps, United States Naval Reserve

The subject of osteomyelitis of the mandible is one in which there is a very exhaustive and complete literature (most of it in dental journals), and it is not the scope of this paper to cover it completely, but rather to bring out a few high lights and pertinent facts in its etiology, pathology, diagnosis and treatment. In general, it may be stated that osteomyelitis of the mandible does not differ greatly from osteomyelitis of any of the long bones or any of the other bones in the body, with the exception that the organisms contained within the oral cavity are generally the primary offenders and thus produce a somewhat different problem. The osteomyelitic process in any bone is essentially one of thromboses of the minute vessels with ensuing stasis, ischemia, necrosis and sequestration. We shall see that the osteomyelitic process in the mandible does not differ essentially from this pattern.

ANATOMY

A detailed description of the gross anatomy of the mandible is well understood and need not be discussed in detail here. Suffice it to say that the mandible is one of the irregular bones of the body consisting

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of two long bones joined together at one extremity, the point of juncture forming the apex of the chin. Structurally, each half functions as a long bone. Each half is also bent at a right angle to form the angle of the jaw; the free extremity of which forms the temporomandibular joint.

According to Gray, the mandible is ossified in the fibrous membrane covering the outer surfaces of Meckel's cartilages. These cartilages form the bar of the mandibular arch and are two in number, a right and a left. Ossification takes place in the membrane covering the outer surface of the ventral, and each half of the bone is formed from a single center which appears near the mental foramen about the sixth week of life, and later accessory nuclei of cartilage make their appearance. The inner alveolar border is formed in the human mandible by an ingrowth from the main mass of the bone. From this ingrowth the sockets of the teeth are formed. At birth the body of the bone is a mere shell containing the sockets of the two incisors, the canine and the two deciduous molar teeth, imperfectly partitioned off from one another.

The mandibular canal is of large size and runs near the lower border of the bone; the mental foramen opens beneath the socket of the first deciduous molar tooth. The angle is obtuse and the condyloid portion is nearly in line with the body. After birth, the body becomes elongated in its whole length, but more especially behind the mental foramen, to provide space for the three additional teeth developed in this part. There is increased growth in the depth of the body particularly of the alveolar part to afford room for the roots of the teeth so that in the adult the alveolar and the subdental portions of the body are usually of equal depth. In the adult, the mandibular canal runs obliquely downward and forward in the body where it is placed under the alveoli and communicates with them by small openings. On arising at the incisor teeth it turns back to communicate with the mental foramen giving off two small canals which run to the cavities containing the incisor teeth. In the posterior two-thirds of the bone the canal is situated nearer the internal surface of the mandible; and in the anterior one-third, nearer its external surface. It contains the inferior alveolar vessels and nerve, from which branches are distributed to the teeth.

HISTORY

A clear understanding of the microscopic relations of the teeth to the jaw is also necessary in our study of bone infection of the jaw. According to Maximow, the periodontal membrane, which also serves as periosteum to the alveolar bone, furnishes a firm connection between the root and the bone. It differs from the usual periosteum by the absence of elastic fibers. It consists of separate, thick, collagenous

bundles, which generally run from the alveolar wall to the surface of the cementum in an oblique direction. At the bottom of the alveolar cavity they are thinner, and the softer tissue continues into the pulp. At the neck of the tooth the fibers are especially prominent, are firmly attached to the cementum and are called the "horizontal groups of fibers" of the tooth. Nearer the surface they run from the bone upward to the edge of the cementum. The fiber bundles of the periodontal membrane have a slightly wavy course; when the tooth is not in function, they are relaxed and permit a slight movement of the tooth upon application of stress.

In many places in the thickness of the periodontal membrane, blood and lymph vessels and nerves embedded in a small amount of loose connective tissue, and small islands of epithelium are scattered, especially near the surface of the cementum. These islands are vestiges of the epithelial sheath of Hertwig which plays an important role in the development of the root. The epithelial rests frequently degenerate and undergo calcification, giving rise to small calcified bodies, the cementicles.

The gum is that part of the mucous membrane which is tightly connected with the periosteum at the crest of the alveolar bone. It is also linked to the surface of the tooth by the epithelial attachment of Gottlieb, which gradually approaches the apex of the tooth with advancing age. The gum has very high papillae. The epithelial attachment is devoid of papillae except when chronically inflamed. Between the epithelium and the enamel there is a small furrow surrounding the crown, the gingival crevice. No glands are found in the gums. The gums help to provide much information as to the health of the individual. Here is seen the black line in bismuth or lead poisoning, or the spongy and bleeding surface and loose teeth in mercurial saturation. Likewise, in malnutritional diseases, like scurvy, it appears in the gums early. It has been noted that hypodermics of dilaudid will produce marked hypertrophy of the gum tissues.

The remainder of histology of the mandible is essentially that of any flat bone that is a hard outer layer of compact bone surrounding an inner spongy bone with exception of the presence of the canal for mandibular vessels and nerves. There is little doubt that the latter plays an important role in the spread of infection.

ETIOLOGY

The etiology of osteomyelitis of the mandible may be divided into the following classifications:
1. Hematogenous osteomyelitis.
2. Traumatic osteomyelitis.
3. Odontogenic osteomyelitis.

Of these three, our discussion will mainly center around the latter two.

Hematogenous osteomyelitis of the mandible differs in no respect in its onset and course from that in any other bone in the body. It is essentially a systemic disease marked by an acute septic onset (septicemia) and the lodging of the blood-borne bacteria in the minute capillaries and venous sinuses of the bone spaces in the jaw. It is believed by many writers that osteomyelitis of the mandible in children is essentially of hematogenous origin. This has been discussed in my paper of 1934 (15).

Traumatic cases of jaw osteomyelitis are practically always the result of a jaw fracture caused by an external blow on the face and mandible. In almost every case of fracture of the mandible there is laceration through the mucous membrane of the mouth forming a communication with the mouth secretions, giving access to the bone of the extensive and virulent mouth bacteria. As a consequence, most every case of jaw fracture is complicated with a certain amount of bone infection, and its pathogenesis depends upon the extent of the fracture, laceration and contusion of bone, and the natural resistance of the individual.

Odontogenic osteomyelitis brings into consideration many allied conditions of the teeth, not the least of which is caries of the teeth. Caries of the teeth begins in the nooks and crannies of the irregularities of the crowns of the teeth. Particles of food gather there providing perfect media for the growth of mouth bacteria, molds, fungi, and allied organisms. The enamel and underlying dentin break down, and the underlying dentin softens, and a cavity results. As long as the pulp of the tooth is not involved, the integrity of the tooth remains unviolated. Osteomyelitis of the jaw is never caused by this condition. But as soon as the process extends itself to involve the pulp cavity, the root bacteria can find their way through the communicating channels into the interior of the jaw bone, setting up a periapical abscess or other types of focal infection and extend into the depths of the bone; this process is not an impossible means of producing osteomyelitis.

A possible source of direct extension from the mouth to the jaw bone is by means of infection of the gingivae in which there is an extensive infection of the gums around the neck of the teeth, and lowered resistance allows an invasion of the bacteria into the recesses of the bone. Here mild trauma may play a part. However, the greatest source lies in operative procedure on the teeth, extractions being carried out in the presence of mouth infection or in the presence of extensive periapical abscesses or other infective processes about the teeth. The operative trauma associated with the extraction of any tooth associated with a concomitant infection in or near the region of

that tooth cuts a wide open swath to the front line of osteomyelitis. There is not only damage to the protective wall of the blood cells and leukocytes, but there is also tearing of capillaries, lymphatics and periosteum of the bone. The so-called abscessed tooth should not be taken lightly by either the dental surgeon or the layman. It is a potential source of much pain, suffering, and even death.

This brings up the question whether teeth should be removed in the presence of an acute infection. Writers in dental literature differ widely in their opinions as to when a tooth should be removed. Some believe that tooth extraction acts as the most simple procedure as a means to provide drainage. Others believe, as has been set out above, that extraction provides extensive damage to the walled off process and spreads the infection. This question we shall leave in the hands of clinical experience. It is this writer's firm belief that a tooth should not be extracted in the presence of an early acute infection, but that time should be allowed for the body to build up its local resistance before removal.

It has been noted by those doing a considerable amount of oral surgery that there is, seemingly, an undue amount of mandibular osteomyelitis resulting from the extraction of the third molar. This may be explained by the fact that in the majority of individuals, the third molar is partially or poorly erupted. Many cases have been seen in which there is no eruption of the third molar, the teeth remaining embedded in the alveolar ridge. This may be, and most likely is, a penalty paid by man in his advance up the evolutionary scale, for it has been noted that there seems to be a gradual shortening of the lower jaw in civilized man. Aborigines most always have a complete set of third molars which function as nature intended them to do. It may be that this can be explained on the basis of early use of the jaws in masticating harsh, coarse foods. It is also noted that often the third molar is covered by a flap of gum tissue designated as an operculum, so called from its fancied likeness to a lid or cover. As in the development of dental caries, this little nook provides an ideal homestead upon which bacteria may settle and develop countless numbers of virulent progeny. Operative surgery, therefore, in this region meets with and scatters deep into the tissues a ready equipped army which is only too willing to invade a tougher element of the jaw bone proper, this even in an apparently clean healthy mouth and gums.

PATHOLOGY

Osteomyelitis is an early inflammation of the bone marrow to which the bacteria have been borne by any of the above named sources. In acute osteomyelitis, the microscopic picture is one of hyperemia with serous exudation. This is seen in the narrow spaces, in the haversian

system and in the cortex of the bone. The slow rate of blood circulation and the venous pools favor a more or less rapid extension of the process in this region. Thromboses form which favor the production of minute abscesses, there is necrosis of the bone, and the abscessed spaces are enlarged. This gives the appearance to the cortex of worm-eaten wood. There is a certain amount of new bone formation which, however, is rapidly destroyed by the infected process. Often there is seen extension of the process through the cortex of the bone to the subperiosteal region, and the inflammation extends between the periosteum and the cortex of the bone, causing an exquisitely tender abscess.

After the infection goes into its more chronic stages, small or larger pieces of bone surrounded by inflammatory or granulation tissue become separated from their blood supply, die and form sequestra. These show evidence of osteoclastic resorption. The mandibular nerve canal may, and often is, invaded by the infection providing an excellent pathway for spread. Round-cell infiltration with edema extends into the perineurial sheath of the nerve. Osteoclasts attack the inside of the canal wall, according to Bauer (12), particularly when the process is under some pressure.

Some authors make a differentiation between osteomyelitis and osteitis of the bone. Osteitis is an infection of the bone starting from a focal point producing progressive and complete destruction of the bone. It is often spoken of as "caries" of the bone. It differs from osteomyelitis thus in its local character. Osteitis is seen in phosphorus, arsenic, and other types of necrosis caused from inorganic sources. Apparently, there is some confusion as to the differentiation between a true osteitis and osteomyelitis. For the purposes of this paper, we need not consider it further.

According to Bauer (12), in acute periapical inflammation of a tooth there is a development of a typical osteomyelitic process with predominating osteoclastic resorption of surrounding bone due to hyperemia and edema of the adjacent tissues. The surrounding bone marrow is rapidly involved, containing hyperemic blood vessels, many polymorphonuclear cells, and shows an enlargement of its spaces due to resorption of the bone trabeculae. Suppuration occurs in the soft bone filling the marrow spaces with pus. There may be, then, extension of the process described above. Bauer also confirms the fact that the mandibular canal is an anatomic highway for extension of jaw infection. This, perhaps, explains the reason why hyperesthesia of the lip and cheek occurs in early osteomyelitis followed by hypo-esthesia. He also confirms the fact that there is regeneration of the nerve following the subsidence of the infection which explains the return of normal sensation to the lip and face following acute infection.

From an x-ray standpoint, there is early no sign of infection. Later in the progress of the disease there may be present the evidence of periosteal elevation; this is seen if the process extends outside the cortex. Later, the x-ray may show osteoporosis. This condition is often seen in the alveolar bone between the teeth. Later, in the cortex the spots become larger, or long channels appear. These channels will demarcate sequestra. Dental films are not satisfactory and are often a cause of mistaken diagnosis. Roentgen examination plays an important part in treatment, particularly as an aid to the location of sequestra. It must be reemphasized, however, that surgical intervention may be called for long before there is x-ray evidence of bony damage.

DIAGNOSIS

The diagnosis of osteomyelitis of the mandible with the exception of acute hematogenous osteomyelitis is a relatively easy clinical procedure. There is generally a history of trauma such as a blow on the jaw with resulting jaw fracture, or tooth extraction. The patient complains of pain at the site of injury. There is generally swelling, edema, and hyperemia of the surrounding tissues. In the case of a fracture, early in the course of the process the primary condition overshadows the development of osteomyelitis, but within a few days time, there is noted a foul odor to the breath, and the patient complains of a bad taste in his mouth. The above mentioned signs and symptoms will then be apparent.

If the mandibular canal is involved, hyperesthesia of the face and lip will be noted. In odontogenic osteomyelitis the only differential diagnostic point will be the history of tooth infection or dental manipulation. There will be an accompanying elevation of the body temperature and general malaise if the process is extensive and the patient's resistance is low.

Hematogenous osteomyelitis is essentially a blood stream infection, and the clinical picture will be that of a septicemia in which there are wide swings in the temperature curve and generalized debility and prostration. The x-ray examination, as has already been pointed out, will early be of little benefit. It is generally not before the eighth day of the disease that diagnostic signs can be found in the x-ray.

Complications resulting from osteomyelitis may include any pyogenic process which might extend locally or systemically from the foci of infection. These include other points of osteomyelitic infection, suppurative and nonsuppurative arthritis, infections of the body cavities, heart involvement, lung involvement, kidney involvement, and soft tissue abscesses. These are common to all types of pyogenic infections. There are, however, a group of local complications which are of interest. These are listed by Wilensky (8) as follows:

1. Ankylosis of the temporomaxillary articulation.
2. Phlebitis of the facial vein radicals which may cause cavernous sinus thromboses.
3. Extension downward into the facial planes of the neck.
4. Mediastinitis.
5. Involvement of the local lymph nodes and lymphatics.

TREATMENT

The treatment of osteomyelitis of the mandible may be divided into three main procedures as follows:

1. *Prophylaxis.*—This is the most important point in the prevention of any infection of the mandible from an odontogenous source. The dentist should make an attempt to clear up all forms of mouth infection before attempting any manipulation. He should appreciate and extend his dental aseptic technic, and above all, learn gentleness in his procedures. In extraction of third molars in which there is present an operculum, the area should be cleansed as thoroughly as possible, and the flap lifted up and thoroughly sterilized as much as possible by an acceptable mouth antiseptic. Packing of teeth following extraction is not recommended as the packing impounds secretions in the tooth socket and forms an ideal incubator for bacteria. For abscessed teeth, conservative measures should be followed for a least 24 hours in order that the body may form a protective wall, and then a clean extraction should be done. Curettement of the dental cavity is not recommended.

2. *Local.*—The surgeon should proceed with the usual treatment of pyogenic infections such as the application of hot moist compresses and external dependent drainage for the collection of pus. If the etiological factor is a fracture, immobilization of the fragments should be carried out by any of the approved methods.

3. *General.*—The patient should be placed at bed rest if the process is acute, and his caloric and fluid intake adequately maintained. If there is evidence, at any time, of blood stream involvement, the etiological factor should be determined by blood cultures and adequate chemotherapy instituted. Drs. John and Edward LeCocq (3) have used neoarsphenamine in the treatment of staphylococcus blood stream infection and concomitant osteomyelitis. Their dosages have been more or less empirical, the routine has been to administer an initial dose of 0.15 gram and to increase the dose gradually over a period of 3 days to a maximum of 0.45 gram. No more than 7 doses of the drug have been administered.

Osgood (11), in his work on bone marrow cultures, has found that the dosage should be body weight in pounds divided by 330. This indicates the total dose to be given on the first day in 3 or 4 divided doses. On each following day, ¾ of this dose is administered divided into 3 spaced doses. This procedure is carried out until the patient has been afebrile for from 6 to 10 days. In other types of mixed infection of the jaw, which is usually the case, sulfathiazole used in its recommended dosage is believed to be of some advantage. Ordinarily, however, it is the opinion of most writers on this subject that conservative treatment suffices, and that following the provision for dependent drainage, the surgeon should wait for the formation of sequestra and

remove them. It is rarely advisable in jaw osteomyelitis to proceed with radical surgical procedure early.

For the past 10 years the essayist has been Chief of the Oral Surgery Department of the King County Hospital, Seattle, Wash. Fifty-two patients with acute osteomyelitis of the jaw came under his observation there and 21 in private practice have been treated by him. Ten cases followed extraction of a lower molar tooth under local anesthesia using the mandibular block and infiltration around the tooth. The osteomyelitis is caused by a poor technic in elevating the periosteum, thereby causing a loss of blood supply to the cancellous bone. Nine of the above were from advertising dental parlors and one from an ethical dentist. All received external drainage by means of the Penrose drain. When a compound fracture was found the Penrose tubes were inserted to the lingual and buccal surfaces of the mandible. Complications followed in 8 and were due to the extension of the infection into the neck causing a cellulitis which required opening of the fascial space as advocated by Mosher (16). Four cases had a complete loss of bone which necessitated the grafting of new bone to get union and a normal functioning jaw. There was one death due to thrombosis of the facial vein with extension into the caverous sinus. The average time required for cure was from 6 to 8 months, a few took 2 years to effect a cure.

SUMMARY

1. The condition of the gums gives one a most helpful clue as to the health of the patient.

2. Extractions should not be made in the presence of an acute infection where a delay is possible.

3. The third molar region is the most vulnerable part of the jaw.

4. A general is preferable to a local anesthetic.

5. Treatment by conservative methods should be the rule.

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SUGGESTED PLAN FOR AVIATION DISPENSARY UNITS AT ADVANCE BASES [1]

By Lieutenant Commander Henry A. Monat, Medical Corps, United States Naval Reserve; Lieutenant, junior grade, W. J. Thompson, Civil Engineer Corps, United States Navy; and Ensign V. G. Stevens, Civil Engineer Corps, United States Naval Reserve

GENERAL

At all advance base air stations it is necessary to provide medical services and attention for the operating personnel. Since an advance base may be classified as temporary, the aviation dispensary unit in order to satisfy the working requirements of air organization must meet the following points:

1. It must be set up in the quickest possible time.

2. It must be constructed so that efficient medical service and comfort can be rendered.

3. It must take into consideration the additional aviation medical problems incidental to serving an air organization. With these points in mind the writers devised the plan shown in figure 1 as described in this article. This plan was decided upon after studying several alternate lay-outs and floor plans within the huts.

MEDICAL ASPECT

The lay-out as decided upon by the writers requires 4 Quonset type huts. It has a capacity of 16 hospitalized patients, quarters for a medical officer and a corpsman, dispensary and office, standard aviation darkroom, provisions for minor surgery, laboratory and sterilizing equipment, storeroom and waiting room.

The hospitalized patients are segregated in the following fashion: 10 beds allocated for enlisted personnel, 3 beds for officers, and 3 beds for isolation. Officers' ward, isolation ward and enlisted men's wards are separated. Waiting-room patients are ushered either to the dispensary for their sick calls or are taken to the surgery and examining room where aviation medical examinations, first aid, emergency surgery, or laboratory tests can be performed. Off the examining room is a darkroom for refraction, eye muscle balance studies, or depth perception tests. There is a small storage room with built-in shelves for medical supplies.

The units also have quarters for either a junior medical officer and a senior physician, or a chief aviation pharmacist's mate and a physician. It is the opinion of the writers that these men should reside close to the patients in order to give constant medical attention, as an air organization with wartime flight schedules must have a physician present at all times for any emergency.

ARCHITECTURAL AND STRUCTURAL ASPECTS

By arranging the huts in the form of an **H**, as shown in figure 1, a more compact dispensary unit is provided and a minimum amount of space is required for a building site. Four Quonset huts are required for the unit, and are divided as follows: One 10-bed ward, one aviation examining hut, and two receiving wards. Except for partitions and shelves placed in the examining hut, the standard plans for these types of huts have not been altered. It is possible to construct the partitions and shelves from lumber used for crating the hut material thus obviating the shipping of additional items. The covered passage is constructed of shiplap or T & G material, and 2 by 4's are used for framing. A shell-type roof will be the most simple to construct and can be covered with roll roofing. The passage is wide enough to permit stretchers to pass into the corridor and then into any one of the four huts. It is the plan of the writers to use the corridor as a reception room. In addition to this, foul weather clothing, overshoes, or other heavy outer clothing may be removed in the reception room and thus add to the general cleanliness of the entire dispensary. To promote a more sanitary condition, the floor of the entire unit should be covered with linoleum. It is desirable, though not necessary, to have a window at each end and two windows at the center of the passage. With the exception of the door in the hut containing the doctor's quarters, all the outside doors of the huts will normally be inactive and used only as emergency exits.

AVIATION DISPENSARY UNIT
ADVANCE BASE AIR STATIONS
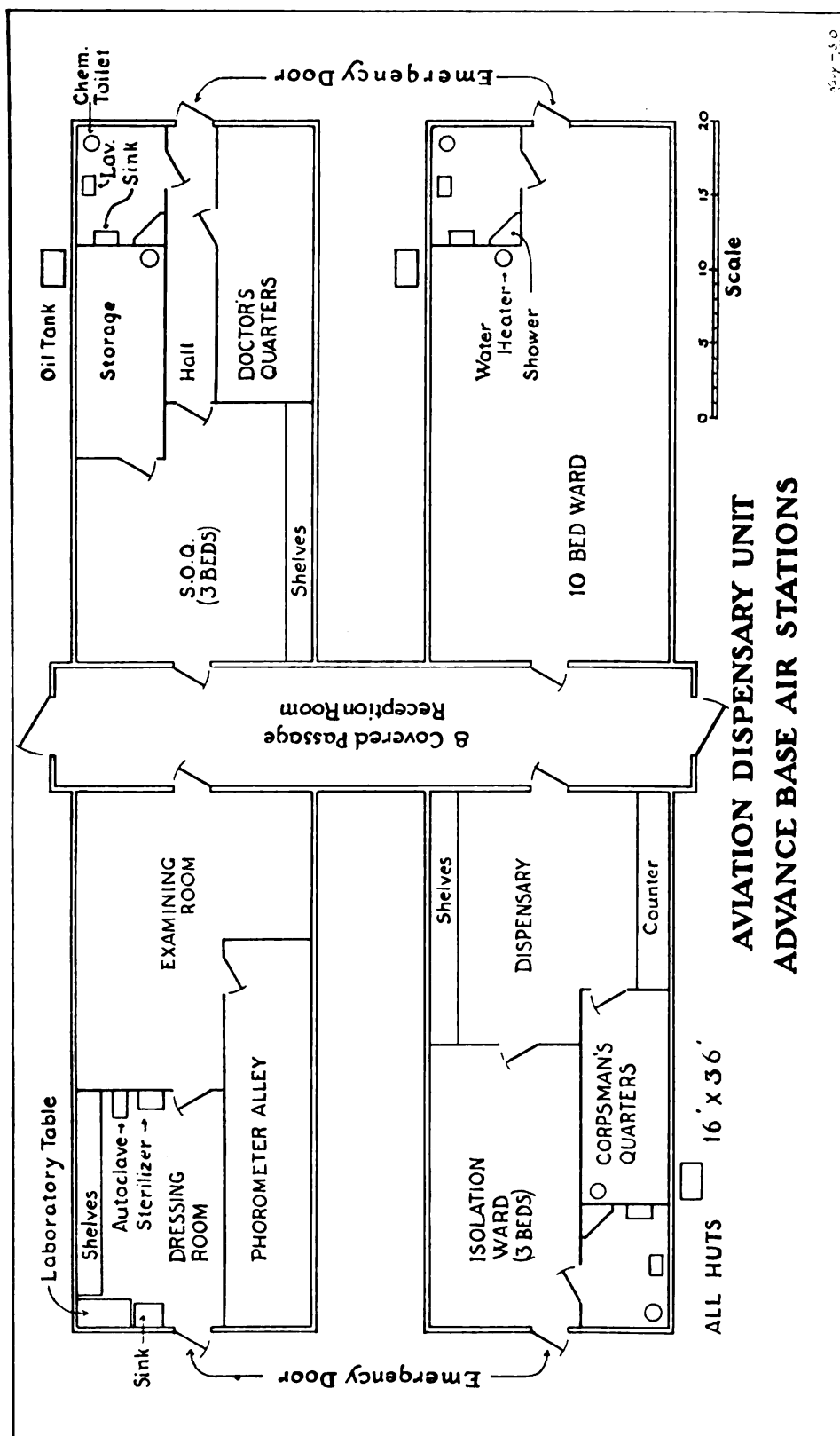
FIGURE 1.

Material for the passage consists of the following items:

> 32 pieces 2″ x 4″ x 12′.
> 80 pieces 2″ x 4″ x 10′.
> 1,200 feet b. m. shiplap or T & G (1 x 6 or 1 x 8, 10′ and 12′ lengths).
> 500 feet b. m. No. 2 common pine flooring.
> 4 squares roll roofing.
> 15 lbs. 6d common nails.
> 40 lbs. 8d common nails.
> 20 lbs. 10d common nails.
> 40 lbs. 16d or 20d nails.
> Hardware for 4 doors.

The **H** plan, in addition to requiring the minimum amount of ground space, uses the least amount of piping for the plumbing system. With this lay-out the length of pipe between the different buildings has been reduced to the minimum and does not require the use of anything other than standard fittings. The toilets were placed in the outer corners of the huts rather than adjacent to the passage for ease in cleaning out the chemical tanks. Furthermore, with the clean-out openings for the chemical tanks out in the open rather than under the passage, a more sanitary condition will exist when cleaning the tanks. Also, the location at the outer corners lessens the likelihood of objectionable odors permeating the interior. It was felt that having the vents concentrated close to the building would not allow as good dispersal of fumes from the chemical tanks. The toilets contain a chemical seat, lavatory, sink, and shower. Hot water is provided by a self-contained heating unit and a tank having a capacity of 20 gallons. These facilities are the regulation equipment furnished for standard receiving-ward huts.

The electrical system includes standard conduit, outlets, and fixtures as furnished with the receiving ward, the 10-bed ward, and the aviation examining hut. In addition, spare electrical fixtures should be included so additional outlets may be installed. This is particularly necessary so that there will be sufficient outlets for medical equipment in the dressing room, examining room, phorometer alley, and for bed lamps in the wards. It is desirable to place night lights in the wards and toilets. Three or four lights in the covered passage will provide adequate illumination.

CONCLUSION

1. A suggested plan for an efficient advance base aviation dispensary unit has been discussed from a medical and structural standpoint.

2. This plan incorporates the essential medical needs to care for an advance base personnel.

3. This type lay-out meets the prime essential in advance base construction, namely, speed.

4. It meets the requirement of simplicity by virtue of the fact that stock, demountable Quonset huts can be used.

5. It is hoped that such units will be adopted as standard by the Aviation Medical Section of the Bureau of Medicine and Surgery.

MESS HALL PLANNING [1]

By Ensign T. L. Jackson, Hospital Corps, United States Navy, and Chief Pharmacist's Mate Paul Shadel, United States Naval Reserve

With the patient capacity of naval hospitals growing by leaps and bounds, it is apparent that new methods for simplified "mass feeding" must be adopted. Any reader who is familiar with the noise, disorder and confusion which results when an activity is suddenly called upon to subsist twice or three times its normal complement, must realize that a well-planned, efficient mess hall is a highly important factor in a hospital command.

Diagram A is a typical scullery installation which is now in operation in many naval hospitals.

It will be noted that the mess line enters at the left, passes successively by the dish rack, the steam table, and then fans out into the main mess hall.

After finishing eating, the individual carries his mess tray to the service window of the scullery where the garbage is scrapped and the dishes placed in racks preparatory to being washed. This system operates satisfactorily when only a small number of ambulatory patients and staff are subsisted, but when that number is doubled or tripled, the following complications ensue: Dish storage racks are insufficient to accommodate sufficient mess gear for all personnel, there-

Typical Scullery Installation

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[1] Received for publication March 30, 1942.

Diagram B

Galley

Mess Hall

Proposed Scullery Installation

1 Inclined Ramp.
2 Glass inclosed covered Passageway.
3 Dish Rack (See Diagram C).
4 Twenty-four inch steam table.
5 Scrapping Table.
6 Pre-slushing Device for removing gross food particles adhering to dishes.
7 Dish-washing Machine.
8 Drying Table.
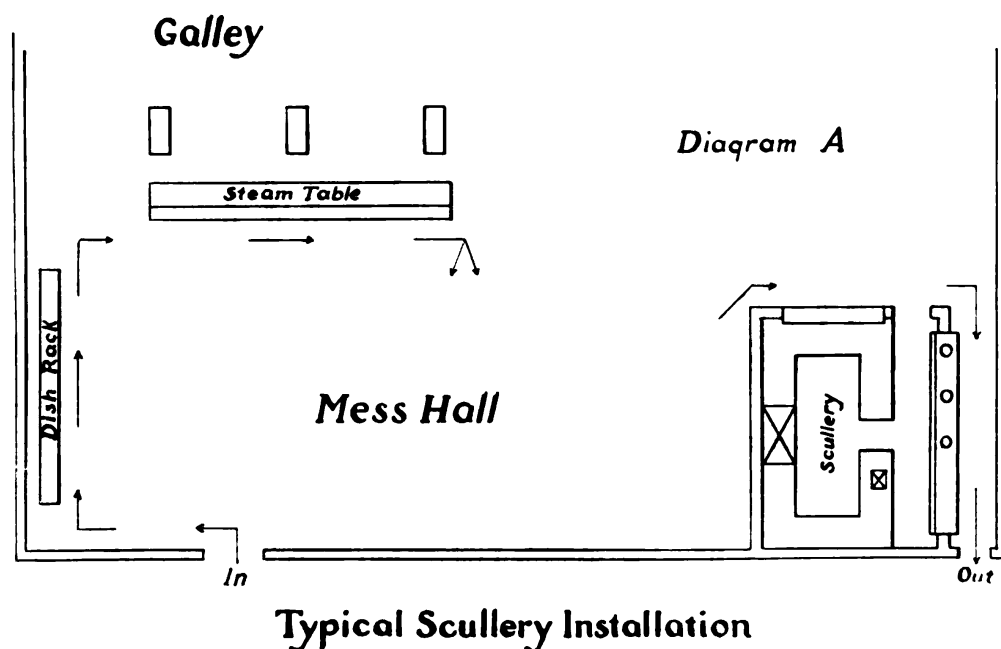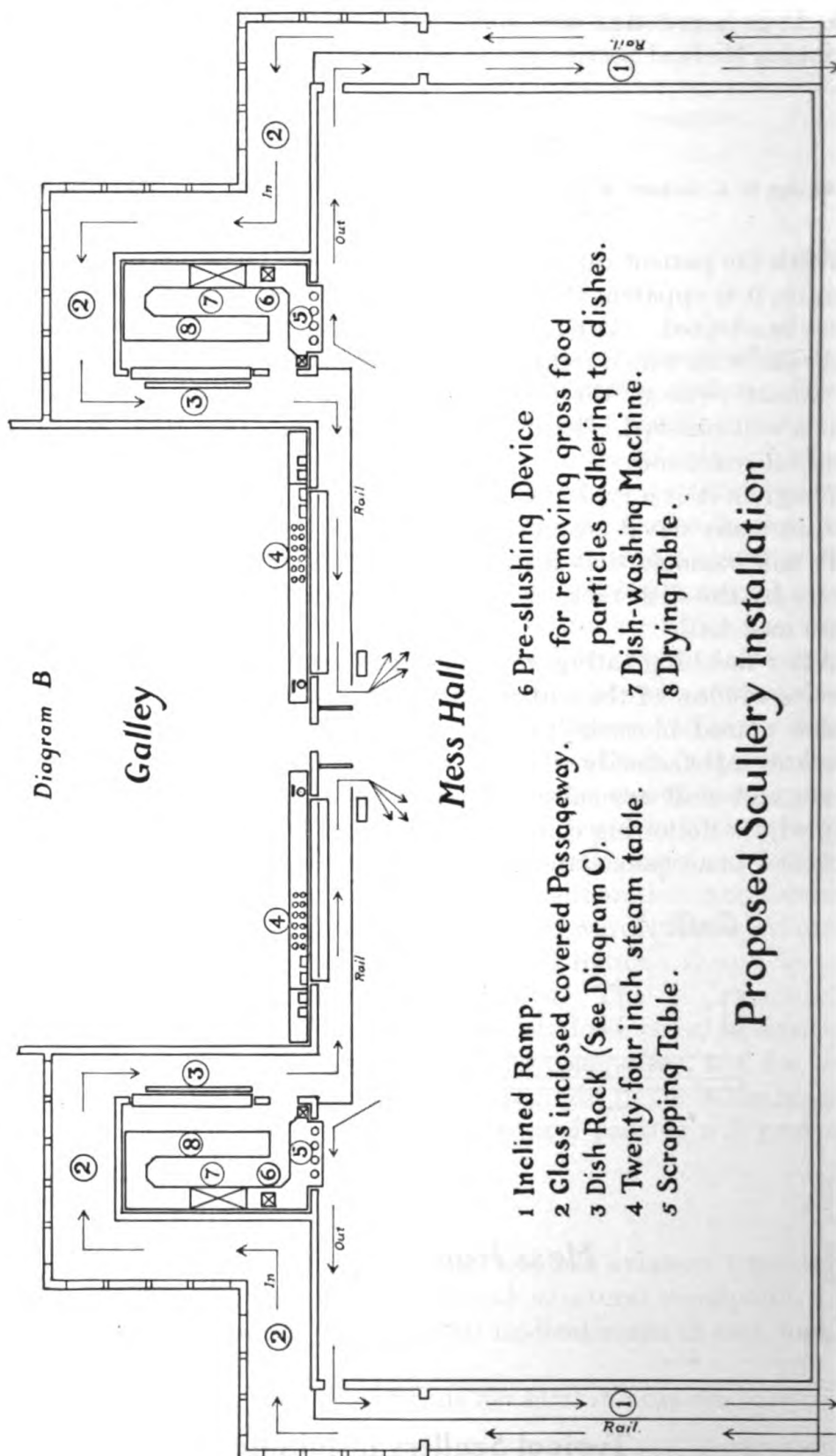
fore, trays, plates, cups, and silverware must be placed back in service as quickly as washing and sterilization is accomplished. This usually involves loading the mess gear on to dish trucks, proceeding across a crowded mess hall to the dish rack and interrupting the mess line while the racks are being restocked. In the process, the mess line is delayed, dishes are broken, and a great deal of noise and disorder is created.

It seems apparent, from a study of diagram A, that confusion could be minimized by establishing a system whereby the scullery, if placed immediately adjacent to the dish storage rack, would eliminate the trucking of mess gear. Such a system is diagrammatically presented in diagram B, arrows indicating flow of traffic.

Here the mess line enters, not through the mess hall proper with a loud clattering of trays and banging of dishes, but through a specially devised covered passageway where trays, dishes and other mess gear are procured from a scientifically designed dish rack, built to accommodate 300 complete sets of mess gear. This passageway is provided with natural lighting and is completely enclosed to provide protection in inclement weather. From this point the mess line passes by the steam table, fans out into the main mess hall and finally leaves the mess hall via the scullery where the dishes are scrapped, racked, washed, and immediately placed back in service through the open back of the dish storage rack. Here the extreme workability of the plan is demonstrated. The continuous cycle which begins when the first individual picks up his mess gear is uninterrupted until the last dish is placed back in the storage rack. There are no delays, no cross traffic, no interruptions of the mess line and no double handling of dishes.

Diagram C

Dish Rack
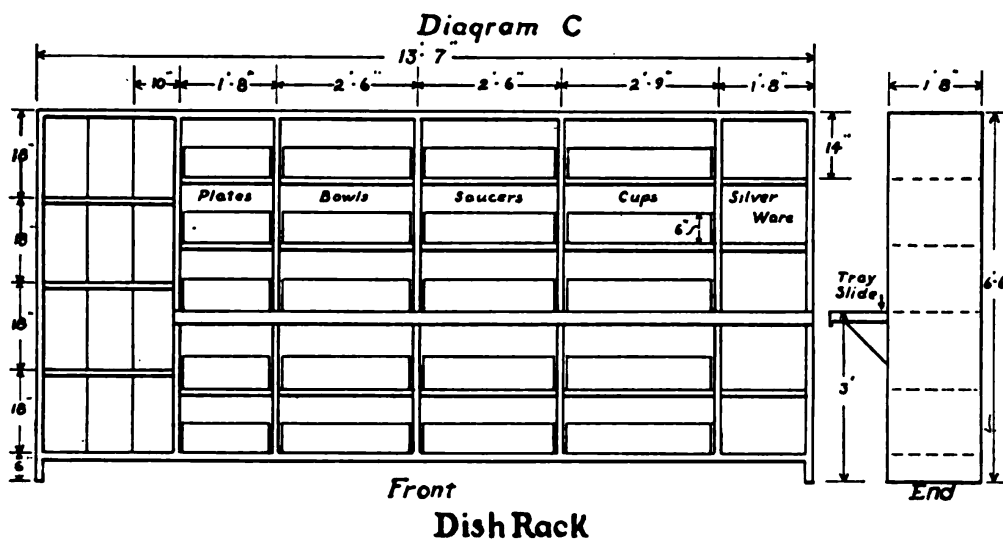
"Mess Hall Planning"

The advantages of this system are briefly summarized below:

1. Reduces number of employees required to efficiently man scullery.
2. Practically eliminates dish breakage.
3. Minimizes dish handling.
4. Eliminates interruptions in mess line caused by replenishment of dish racks, and produces a smooth flowing, uninterrupted flow of personnel with elimination of cross traffic and bottlenecks.
5. Due to the speed with which dishes may be washed, sterilized, and immediately placed back on the storage rack, the actual amount of mess gear in use may be greatly reduced.
6. Under this plan the scullery is located outside the main mess hall, thereby providing better facilities for light and ventilation, reducing noise, and eliminating any partitions or enclosures which normally militate against an orderly and efficient arrangement of mess tables.
7. By elimination of dish storage racks in the mess hall proper and the wide aisles commonly reserved for passage of dish trucks, better utilization of mess hall space is provided.

By using two steam tables and a well trained crew, it has been demonstrated that an average of 30 men can be fed per minute. At the end of a 20-minute period the mess hall described above would be completely occupied. However, within 14 minutes the first man served has finished his meal and is ready to vacate his place at the table. From this point on, the serving, meal consuming, dish scrapping, dishwashing and returning to service of mess gear becomes an unending cycle which may be continued indefinitely.

Finally, a restatement of a long established fact regarding morale. Nothing is more conducive to good morale than good food, appetizingly served in a well-equipped and efficiently operated mess hall. Conversely, nothing is more demoralizing than spending long hours in a painfully slow moving mess line followed by eating a meal in an environment where noise, disorder, and confusion is the order of the day.

A COURSE OF INDOCTRINATION FOR DENTAL OFFICERS AND DENTAL TECHNICIANS [1]

By Lieutenant Commander W. R. Burns, Dental Corps, United States Navy

Under the supervision of the commanding officer of this naval training station, a 10-weeks' course of instruction is given the dental officers of the Naval Reserve, together with line officers of the Naval Reserve and reserve officers of other staff corps, particularly of the Medical and Supply Corps. In this course of study each officer attends two 1-hour weekly sessions, approximately one-half of the number of officers from their respective activities attending the Monday and Tuesday classes, while the other half attends the Thursday and Friday classes. In this course of study the United States Navy

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Regulations are stressed. The Bureau of Navigation Manual and Courts and Boards are studied. Lectures in naval traditions and customs are given. General characteristics of the various types of naval vessels are thoroughly discussed.

The composition of the various forces afloat in our three fleets are thoroughly explained, so that a good knowledge of the Navy's forces afloat is obtained. A written examination is given midway in this course, as well as a final examination, and it behooves each officer to apply himself diligently and to learn as much as possible of the subjects taught and discussed.

In addition to this phase of the indoctrination course, a drill is held weekly for the dental officers of the Naval Reserve and for all enlisted men at this activity. This weekly session, or military drill, is in addition to the commanding officer's weekly inspection of personnel and matériel. Quarters for muster and personnel inspection are under the supervision of the senior dental officer. This weekly drill simulates the commanding officer's personnel inspection aboard ship. Duties of the division officer are stressed in this drill.

For a period of several weeks the reserve dental officers observe the handling of a division, learn what is expected of the division as regards neatness, cleanliness and correctness of dress. The commands for the necessary foot movements of a division are learned. The standard and accepted phraseology in the reporting of a division to the commanding officer at captain's inspection aboard ship is learned. The routine of this personnel inspection is copied after "Admiral's Inspection of the Annual Military Inspection" aboard ship, as is the standardized routine now aboard nearly all men-of-war. Each officer learns the routine of personnel inspection with the division at attention at the approach of the captain and inspection party. The right-hand salute is given by the division. The officer by verbal salutation bids the captain the time of day, followed by a report giving the letter or number of the division, as in our case the "H," or hospital division, the number of men assigned, the number of authorized absentees, and the prescribed uniform for his particular division. When ordered to do so, the division opens ranks. If requested to have inspection of hair cuts, the division officer gives the necessary commands to uncover and to cover upon completion of such part of the inspection. If requested to have sock inspection, the prescribed commands for such are given.

After several weeks of such observation the "H" division at the Dental Infirmary is divided into a number of sections, each section then having about 5 dental officers and about 12 men. Each officer takes his turn as division officer, and in due time, becomes thoroughly familiar with this phase of his military duties The inspection party consists of 3 or 4 dental officers. When on duty afloat, with the medical officer

being a member of the inspection party, this training fits the dental officer for his duties when such duties as division officer of the "H" division devolve upon him. The order, "Officers, front and center; march", is given from time to time so as to develop a degree of military precision and to improve one's military bearing, if that be found wanting. These military drills inculcate a spirit of discipline in the personnel, which is the general idea of military training, so that a person obeys an order subconsciously. This drill is held outdoors comparable to the weather decks aboard ship.

In inclement weather "foul weather parade" becomes a session indoors. At these sessions such subjects as "Articles for the Government of the Navy" are read and explained for the guidance of this personnel. The pertinent facts of courts and boards are reviewed and discussed, such as who are authorized to convene the various courts, the composition of such courts or boards, the punishments meted out according to naval law, etc., all of which is most helpful to every officer and man in the naval service. At such classes for the dental officers the subject of collateral duties for which every officer ashore or afloat may be liable is discussed. Duties as ship's service officer or officer in charge of a department of ship's service are explained.

In time the entire field of such collateral duties is covered: that of athletic officer or being in charge of one sport or activity; being on a cash verification board; ship's service auditing or inventory board; any of the various messes; examining board for hospital corpsmen; membership in any of the various courts martial; surveying officer as for medical property; wardroom mess treasurer, etc.

Duties at emergency drills aboard ship are discussed such as at fire drill, collision drill, abandon ship, at general quarters, or battle stations. The two cardinal points of such drills are brought out: that of maintaining absolute silence, and of going to one's station "on the double" in the proper direction, that is, going aft on the port side and forward on the starboard. This period of training and study has been tentatively arranged to continue weekly from June to October inclusive, and from January to May inclusive, which permits practically all officers and men to be present during one full course.

The course for training of dental technician (general) students covers a period of 10 weeks, a new class commencing immediately after the graduation of the previous one. The lectures or didactic exercises are held 5 days a week from 8:30 till 9:15 a. m. The course of study being strictly of a professional nature embraces the following subjects, only the most important points of which are emphasized due to the limited period of such instruction: Dental anatomy, dental histology, dental pathology, dental materia medica and therapeutics, oral hygiene, and those branches of bacteriology, metallurgy and radiology that pertain strictly to the field of dentistry. This course

serves well as a starting point for a man, in this, his chosen field, and as he goes along and applies himself his knowledge of a particular subject or subjects increases to the extent that he so desires.

Lectures are given on Black's classification of cavities of the teeth. Lectures dealing with the physical properties of various filling materials such as gold, silver, silver and tin to which mercury has been added, or an amalgam, and various kinds of cements. The subject of dental caries is discussed. The preparation of local anesthetics, particularly procaine, is thoroughly explained. Lectures are given these dental technician students on nutrition and its influence on oral development and on oral health. The subjects of sterilization and asepsis are emphasized.

Manifestations of diseases within the oral cavity, such as paradentosis, Vincent's infection, gingivitis, canker sores, syphilitic lesions, such as chancres and mucous patches, are observed and recognized. Scaling and polishing of teeth, and routine treatments in the dental office are taught these men clinically. This course in theory, combined with the practical work at the dental infirmary by these students soon qualifies them as dental technicians and as so many invaluable assets in the dental office ashore or afloat.

Men showing special aptitude for dental laboratory work are assigned to this duty, and dental technicians skilled in the art of prosthesis will soon be trained.

The indoctrination course, together with the military drills for the dental officers, dental technicians, and dental technician students requires just about 3 hours each week. With the great expansion of this naval training station and with many ships, not having the services of a dental officer, putting into this naval base, a great demand for necessary dental services is made on this station. From an humanitarian standpoint, emergency dental services are performed for personnel of friendly foreign ships that come to this port.

The volume of dental service given each month at this station has been extensive, and included such dental operations as fillings, extractions, prothesis, prophylaxis, treatments, and x-ray examinations.

With dentistry being a specialized branch of medical science, the mission of the Dental Corps is that of the Medical Corps: "To keep as many men at as many guns as many days as possible." From such an indoctrination course given the dental officers of the Naval Reserve and the more recently commissioned dental officers of the regular service, and the pursuance of such professional course of study by enlisted members of the Hospital Corps, in addition to learning their military duties, the twofold nature of duty in the Navy is thus being carried out—the military duties and the professional duties. Advantage is thus being taken of the training, schooling and learning that is afforded by the Navy.

TWO UNUSUAL TYPES OF CASUALTY TO NAVAL PERSONNEL [1]

By Commander J. P. Bowles, Medical Corps, United States Navy; Lieutenant Commander L. T. Dorgan, Medical Corps, United States Navy; and Lieutenant, junior grade, J. R. Marron, Medical Corps, United States Navy

Following a recent enemy action we observed two unexpected types of injury to naval personnel. A lack of time and facilities prevented a complete investigation but we are reporting our clinical observations in the belief that they will be of interest to other members of our Corps.

Thirteen cases of dermatitis developed in personnel coming in contact with an orange-yellow powder scattered from an unexploded but fragmented enemy aerial bomb. All of these cases had direct contact with the powder, either through handling of the fragments or during clean-up procedures. It was noted that numerous other men on the ship showed an orange-yellow staining of the hands but did not develop any skin manifestations. It is our belief that the causative agent in these cases was ammonium picrate although a chemical analysis report has not been received.

The time between exposure and appearance of the first symptoms was 3 to 7 days. In each case severe pruritus was the outstanding symptom. The lesions in the 10 milder cases consisted of discrete, red, maculopapules, varying in size from a pinpoint to a dime, with a narrow inflammatory areola, and confined to the forearms, knees and ankles. Within 24 hours these lesions became vesicular and there was much weeping and crusting due to the excoriation from scratching (fig. 1).

The lesions in the other three cases were severe, showing large, confluent, elevated patches distributed over the entire body, being most marked at points where clothes had rubbed. These lesions rapidly became bullous and the patients were moderately toxic as manifested by malaise, fever of from 1 to 3 degrees, albuminuria, and intense pruritus. Two of the three severe cases gave a history of severe attacks of dermatitis from poison ivy or oak during childhood; the third suffered a severe attack of pityriasis rosea about 5 years ago. Apparently, only a hypersensitive type of individual reacted with the more severe dermatitis as these three men suffered no greater exposure than the others.

The skin condition in all the cases proceeded to desquamation and complete recovery, the entire period being from 5 to 6 days in the milder cases, and from 12 to 16 days in the more severe ones.

The ambulatory cases responded rapidly to antipruritic lotions; the severe cases taxed the limited capacities of a ship's nursing facilities but were kept fairly comfortable with alkaline-collodial baths, wet dressings of zinc sulfate, mild sedation, and soothing lotions or ointments.
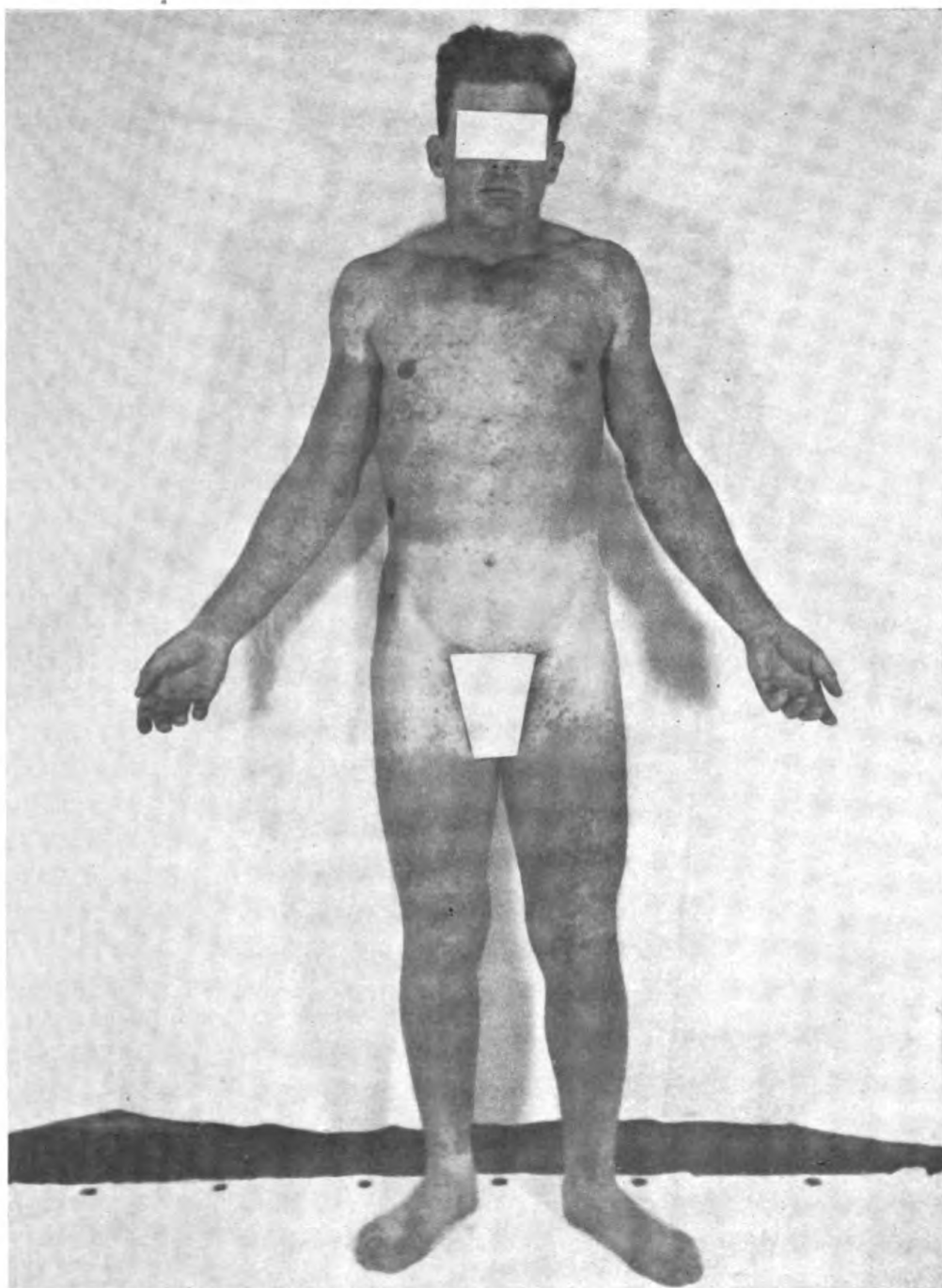
FIGURE 1.—SHOWING AREA OF DERMATITIS CAUSED BY EXPOSURE TO POWDER
FROM AN UNEXPLODED BOMB.

All men were warned of the dangers of contamination from the powder and the entire interior of the exposed compartment was washed and painted; all contaminated clothing was laundered; and all personnel handling bomb fragments were protected. Following the institution of these simple preventive measures no new cases of dermatitis developed.

A second type of reaction observed by us occurred in eight cases resulting from exposure to high-explosive fumes for a prolonged period of time. The noxious agent is believed to have been nitrous fumes. Men were first seen from 10 to 16 hours after exposure. Not one of them could give a coherent account of his actions from the time of first exposure up to admission to the sick list although each was well oriented. All cases were very apprehensive and complained of a sense of constriction in the chest and of severe frontal headaches. Physical examination of each man revealed moderate cyanosis of the lips and fingernails, tachycardia with poor pulse tension, normal blood pressure, and rapid, shallow respirations of an obstructive type. Coughing was severe and continuous being productive of copious amounts of frothy, pinkish fluid. Auscultation of the chest revealed both lungs filled with coarse bubbling rales.

Five of the cases responded well to rest, warmth, and adequate morphine sedation, the symptoms regressing gradually to a complete recovery in from 24 to 48 hours. In the remaining three, the cyanosis and dyspnea became progressively worse, responding only slightly or not at all to the above measures plus continuous oxygen inhalation. These men were transferred to a nearby naval hospital as soon as possible.

The economic seriousness of the dermatitis could have been great had the necessity of going into action arisen during the florid stage of the rash. Most of these men were experienced ratings, indispensable to their particular jobs; their battle stations were usually in small, confined, and hot compartments. None of them could have performed his usual duties with anywhere near maximum efficiency. After recognition of the cause of the condition and the institution of a few simple preventive measures, no further cases occurred.

The occurrence of eight smoke exposure cases from one ship, and the seriousness of three of them, shows that not all of the poisonous gas problems with which the naval surgeon has to contend are due directly to enemy gases. In the stress of battle, men are working in an atmosphere of smoke produced by burning paint, burning oil, and high explosives. Prolonged exposure without adequate protection to these fumes can have almost as serious a consequence as have the so-called "poison gases" liberated by the enemy.

PATHOLOGY AND TREATMENT OF RENAL TUMORS[1]

By Commander Albert E. Bothe, Medical Corps, United States Naval Reserve

The purpose of this study is to establish a better understanding of the pathology of malignant tumors of the kidney parenchyma as a basis for rational treatment. A review of the end results after preoperative irradiation of kidney tumors has been studied to prove or disprove the advisability of preoperative irradiation.

CLASSIFICATION

A classification based upon the cytological findings of the malignant tumors primary in the kidney parenchyma is exceedingly difficult. When therapy alone is considered, these tumors may conveniently be placed under the following groups:

1. Hypernephroma.
2. Adenocarcinoma.
3. Mixed tumors.
4. Neurocytoma.
5. Sarcoma.
6. Endothelioma.

Since there is apparent accord among pathologists and clinicians when neurocytomas, sarcomas and endotheliomas of the kidney are discussed, these types will not be referred to in this discussion.

Although the many contributions about the genesis of hypernephromata are interesting, there are but two that have survived the test of extensive investigation: First, the cortical adrenal rest theory; and second, the nephrogenic cell origin.

PATHOLOGY

Hypernephroma.—The tumor classified as hypernephroma may vary from two or three centimeters in diameter to dimensions equal to the entire left abdomen. They are usually partially encapsulated. They develop with varying degrees of lobulation. On section these tumors usually bulge at the cut surface. A distinct canary yellow is characteristic of the tissues. It may be streaked with hemorrhage, with or without associated different sized hemorrhagic cysts. Localized areas of necrosis are not uncommon; especially are these areas found in large tumors.

The microscopical findings show a predominance of a large polygonal vacuolated cell with a relatively small nucleus. The vacuolization associated with these cells is due to cytoplasmic fat droplets. The vascular network is exceedingly abundant. Interstitial hemorrhage and necrosis are frequent findings.

When many areas of these tumors are studied, in different planes, one finds marked diversity of cellular arrangement. This study was

[1] Received for publication May 22, 1942.

originally carried out by preparing microscopical cross sections of an adult human kidney containing a hypernephroma which measured 8 by 4.5 by 4.5 cm. The later studies were made upon small sections made from different areas in different planes of the same tumors. It was concluded from these studies that the large polygonal vacuolated cell was always present and usually predominates in the tumor.

Also present were groups of smaller polygonal cells, with less mature appearance and devoid of vacuolization. In these groups, embryonal cells in different phases of division were always present. These areas represent the immature proliferating growing part of the hypernephroma. It is upon these areas that growth of the tumor is dependent.

The arrangement of the stroma with respect to the large polygonal cells gives this tumor its polystructural appearance. The structural forms which were seen in the small sections were in accord with the findings previously reported (1).

Hypernephroma of the renal vein.—It is not uncommon for hypernephromata of the kidney to invade the veins and even to extend into the main renal vessel. They have been reported with extension into the vena cava as far as the heart. Hyman (10) reports a case in which the thrombus extended into the renal vein of the opposite side. In a previous report the author has described extension into the vena cava, iliac and lumbar veins. These thrombi may become quite long, but as a rule they give no clinical evidence of vascular occlusion which would be manifested by edema of the extremities. The ureters, as a rule, are free from invasion. In a previous report the author has described extension of tumor tissue into the upper ureter. There was no vascular attachment to the ureter wall. The microscopical studies of the vascular thrombi are identical with cytological findings in the primary neoplasm. Wright (19) has shown that the thrombi are separated from the walls of the blood vessel by fibrin, white blood cells and red blood cells. The tumor cells growing within the lumen of the vessel have no mural connection.

Table 1 illustrates the approximate incidence of renal vein involvement.

TABLE 1.—*Renal vein involvement*

Name of reference	Cases	Renal vein involvement	Name of reference	Cases	Renal vein involvement
Wright	19	4	Bierring and Albert	5	1
Keyes	1	1	Kozoll, Kirshbaum	44	8
Bloch	86	13	Out series	23	2
Hyman	38	8			
Garceau	176	4	Total	392	41

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Involvement of the renal vein with a hypernephromatous thrombus is always a serious complication. When possible, these thrombi should be removed at the time of nephrectomy. Failure to carry out this removal is frequently fatal. There are a few cases reported with renal vein thrombi which were not removed at the time of nephrectomy which did not render the prognosis fatal. The following is a tabulation of these cases:

TABLE 2

Author	Number of cases	Years lived after ne-phrectomy	Author	Number of cases	Years lived after ne-phrectomy
Bumpus	1	6+	Albrecht	1	12+
Foulds	1	2+	Do	1	3+
Do	2	3+	Hyman	1	4+
Do	4	10+			
Albrecht	1	4+	Total	12	

Metastasis.—The hypernephromata frequently give rise to metastasis. The latter may occur early or comparatively late in the course of the disease; they are often widely distributed and develop with marked rapidity. Metastatic hypernephromata are reproductions in structure of the original tumor. There may be some little alteration in the size or arrangement of the constituent cells, but in general the structure is like that found in the primary growth. The dissemination of the cells occurs by way of the blood stream, but involvement of the regional lymphatics is not unknown; and in a few instances the lymphatic vessels alone seem to be concerned in the processes of dissemination. The bones, lungs and liver, are the common sites of metastatic growths. In a certain small proportion of cases, tumors of long standing were unassociated with metastatic growths, two examples having been reported by Ohlmacher in which, notwithstanding the presence of large renal hypernephroma, no metastasis could be demonstrated. Wright (19) refers to 13 cases out of 19 which showed no metastasis.

Metastasis may be a very early feature in the course of the disease and the local growth in the kidney may be undemonstrable notwithstanding that it has given rise to widespread metastasis, possibly with pathological fracture of an involved bone. Smith has reported two cases in which metastasis first drew attention to the disease.

Bumpus (5) reported a patient who had a nephrectomy for hypernephroma. X-ray pictures at the time of operation showed evidence of pulmonary metastasis. Five months later the metastatic lesion was no longer evident. Five years later it was still negative. Bumpus feels this illustrates changes in primary focus by operation or through necrosis; the antibodies may again be formed in sufficient quantity to overcome the invading cells and to destroy the metastatic

foci. Ewing (6) and Peterson (14) have reported similar reactions in the treatment of chorionic epithelioma.

Occasionally, the metastatic lesions become very active after removal of the primary lesion. One patient, a white female, 22 years of age, developed active extensive metastatis to the lungs and died 6 weeks after nephrectomy.

Mixed tumors (Wilms').—This tumor is usually solid, globular to ovoid in shape, often lobulated. It may arise in any portion of the adult kidney. Many investigators give findings which indicate a predilection for the poles. Some cases have shown a definite origin from the pelvis. The tumor is encapsulated and destroys adjacent tissue by compression. It grows expansively and does not infiltrate the kidney tissue until it ruptures its capsule. This probably accounts for the absence of gross hematuria in the majority of cases. The kidney remnants usually show no unusual changes. After the capsule has ruptured, changes in the remaining kidney parenchyma become very apparent.

The microscopical appearance of mixed tumors unlike most kidney tumors, shows a wide variation. One needs only to refer to the terms used in the literature in classifying these neoplasms to realize the diversity of histological findings. Although the predominating growing malignant tissues in mixed tumors of the kidney are anaplastic round cells and fairly well differentiated epithelial cells, it is not uncommon to find smooth and striated muscle, fat, cartilage and bone. In many specimens the diagnosis is descriptive of the prevailing cellular type.

The sarcomatous cells common to these tumors, range from the small round type to the more mature elongated spindle cell with wide variations in intermediate forms. The areas with excessive growth usually have very little stroma or supporting tissue. The vascular network ranges from the immature early formed or forming vessels to the maturely developed types, as seen in normal tissue. The more immature the predominating cells the more numerous are the young blood vessels. The small round cells which are usually grouped in large islands are very embryonal in appearance. They take the stain deeply and although variable in different areas, cells with mitotic figures can be identified. When these small round cell areas merge with those of the more mature spindle type, different intermediate stages of development can be identified.

The epithelial cells in these tumors are also collected into groups. They are usually adjacent to, and sometimes invade, the sarcomatous tissue. They show varying degrees of differentiation. They range from different sized irregular cells to indefinite cuboidal and low

columnar types. The degree of differentiation of the epithelial cells is usually moderately advanced. The tendency, in most sections made from these tumors, is to produce an epithelial cell with a differentiation indicative of moderately advanced self control. They appear as those cells seen in slowly growing tumors. This observation on the epithelial cells is usually common to all the mixed tumors whether the epithelial or the sarcomatous tissue structures predominated the tumor. In many areas the epithelial cells are in ductlike or acinar formation. They are not unlike the arrangement seen in the uriniferous tubules of the kidney. In general, it is usually evident that the sarcomatous tissues in the mixed tumors appear embryonal and radiosensitive while the carcinomatous tissue appears much more radio-resistant.

Although mixed tumors of the kidney usually occur during infancy or childhood, it has been possible to collect 23 cases that occurred in adults.

TABLE 3.—*Age status in adult series*

Author	Age	Author	Age	Author	Age
Hyman	22	MacDonald	50	Priestley and Broders	24
Muus	34	Rahde	52	Do	38
Kocher and Langhans	35	Hedren	54	Geschickter and Widenhorn	40
Albarran and Imbert	37	Moas	55		
Nicholsen	40	Bouman	59	Clay	80
Jonckel	43	Thatcher and Fulmer	59	Kretschmer and Randoph	55
Keefe	44	Davis	59	Abbe	67
Hasner	45	Kilbane and Lester	48	Jenkins	67

Adenocarcinoma.—Since the pathologists and clinicians are agreed about the genesis and pathological findings in the adenocarcinomata of the kidney, a description of this tumor will be omitted at this time. The cytological findings will be referred to in the discussion under irradiation therapy.

TREATMENT

The treatment of tumors of the kidney parenchyma is divided into preoperative irradiation, surgical removal and postoperative irradiation. In recent years there has been accumulated considerable information about radiosensitivity of tissue. The results of this study based upon the literature and personal experience has given rise to reasonably definite conclusions about the value of irradiation. Before discussing advantages or disadvantages of irradiation therapy in the treatment of these tumors, a brief review of the laws governing radiosensitivity is in order.

Stewart (18) has defined radiosensitivity as that combination of circumstances resistant in a tumor or the host which permits marked or total local tumor regression under doses of radiation sufficiently small

to preserve the integrity of the tissues of the host. Although the actual mechanism of radiation destruction is somewhat vague, considerable information has accumulated showing that different cells show different degrees of sensitivity to roentgen therapy.

Many general factors have to be considered when radiosensitivity of tumor cells is discussed. If the patient is not in a good general condition, the results of irradiation are poor. All investigators are agreed that anemia and cachexia impair the effect of the therapy. When the patients are undernourished, they are usually made worse by irradiation and the tumor is unchanged. Fatty tissue offsets the desired effect of irradiation. Actively associated infection interferes with roentgen therapy. An overproduction of secretion such as mucin is also antagonistic. Indolent connective tissue, the result of successive inadequate treatments, adds greatly to the resistance. Ewing feels that this is a strong argument in favor of the view that the destruction of tumor cells by irradiation results largely from a normal inflammatory tissue reaction. These are a few of the general factors that frequently interfere with successful irradiation, although the tumor cells may be of a sensitive type.

The highly radiosensitive cells are very embryonal. They are poorly differentiated. It is a delicate cell that apparently lacks a tough membrane. It is a cell with a rich fluid content and does not have the tendency to form fibrous tissue. The characteristics of the origin cell apparently have a great influence upon its sensitivity. For example, the tumors of lymphoid origin are easily destroyed by irradiation, while those of nerve origin are very resistant. The former represents a cell with a short life cycle, while the latter represents one with a long cycle. Steward (18) feels that a high metabolic rate may be assumed for rapidly growing anaplastic tumors, but unfortunately not all such tumors are sensitive to irradiation and some are highly resistant. It seems certain that embryonal appearing anaplastic tumors made up of short life-cycled cells coming from lymphoid or similar tissues are the most radiosensitive.

Hypernephroma.—When the hypernephromata of the kidney are analyzed from a radiosensitivity point of view they show the greatest diversity of antagonistic factors. These tumors are well circumscribed, the result of condensation of the surrounding tissues. The tumor tissue has a yellowish fatty appearance, is prone with the release of tension to bulge somewhat and usually shows some degree of hemorrhagic necrosis or cyst formation. Rarely is the tumor subdivided into lobules by bands of fibrous tissue; complete encapsulation has existed at some stage in the development of the tumor. A portion of the growth may be covered by a thick, dense, fibrous capsule which is almost invariably and completely wanting at the point where renal invasion has occurred.

The prevailing neoplastic cell, while presenting slight variations in size, is of the large polygonal type, consisting of a small nucleus surrounded by a clear vacuolized cytoplasm. The cells nearest the center show the usual signs of retrogressive changes. The predominating cells in hypernephromata show the greatest diversity of arrangement.

When the laws governing radiosensitivity are applied to the pathological findings in hypernephroma, it is evident that many of the characteristics should be antagonistic to irradiation. First, this tumor has an excessive amount of intracellular fat; second, cystic degeneration and necrotic changes are frequently seen; and third, the predominating cells are large, well outlined and fairly well differentiated. Although the cells are malignant, they present considerable histological evidence of self-control. These findings undoubtedly must tend to offset the beneficial effect desired from irradiation.

Usually there are associated areas in these tumors with collections of anaplastic cells that appear to lack antagonistic features. In these areas, the cells are much smaller, they are more embryonal in appearance and present most of the characteristics seen in a radiosensitive tissue. These areas probably represent early stages in the development of the large polygonal vacuolated cell so commonly found in hypernephroma.

The microscopical studies of the tumors studied in 50 cases show that anaplastic areas involve an exceedingly small part when compared with the more mature and radio-antagonistic areas. It was these anaplastic cellular islands which the author, in 1934, felt should be satisfactorily destroyed by preoperative irradiation. Since this suggestion, studies have indicated that there is little or no change in these areas after irradiation. Although many radiologists have suggested preoperative irradiation of this tumor. Waters has been the most enthusiastic exponent. He states that all hypernephromata are radiosensitive. He reports 21 out of 23 cortical tumors proved to be radiosensitive as shown by regression in size and degree of destruction as revealed later by microscopic study. This is the only report of its kind that was available in the literature.

It is concluded from the pathological studies and cases reported, that preoperative irradiation of hypernephromata should never be advised except for palliation. The reasons for these conclusions are first, personal experience with preoperative irradiation has proven the tumor resistant as should be expected from the nonirradiated tumor findings, second, the vascular changes during irradiation whether the tumor is sensitive or resistant are probably traumatic, which in turn may predispose to vascular or lymphatic dissemination; third, the results when preoperative irradiation has been utilized do not indicate that this procedure has been of value. In the entire group (24 cases) Waters does not have a 5-year cure. Most of the patients

died within 2 years after irradiation and surgical removal, while the cases herewith referred to (2) died within 1 year. Fourth and equally as important is the injurious effect of transit and exit irradiation upon adjacent organs and tissues.

Adenocarcinoma.—The adenocarcinoma group of kidney tumors which probably develop from the tubular epithelium or nephrogenic inclusions show little or no evidence of radiosensitivity. The predominating cell in these tumors is fairly well differentiated. They are usually cuboidal or low columnar types with a fairly definite outline. The arrangement is usually irregular, acinar and tubular formation depending somewhat upon the plane in which the sections are cut. When the laws governing radiosensitivity of tissues are applied to this tumor, it becomes evident that the tissue is a radioresistant type. While many writers have failed to differentiate between hypernephromata and carcinomata, it seems justifiable from the pathological findings to conclude that the adenocarcinoma like the hypernephroma is most effectively treated when preoperative irradiation is not given.

Wilms' tumors.—The microscopical appearance of the nonirradiated mixed tumors shows a wide variation in cellular types. Although the predominating malignant tissues are sarcoma and carcinoma the former usually predominates. When pathological findings are studied from a radiosensitivity point of view, the anaplastic sarcomatous tissue predominates. When these tumors are exposed to irradiation therapy they should and do undergo regression. The extent of this regression from irradiation may be so extensive that a large tumor may no longer be palpable.

Seven mixed tumors of the kidney were studied after irradiation. The irradiation had caused regression ranging from one-half to one-tenth of the original size. Many sections were made for microscopical study. These were taken from different areas and in different planes. The essential findings in these sections were first, epithelial cells; second, small clumps and scattered small round cells; and third, a diffuse fibrosis which was very abundant in some areas. The epithelial cells were mostly the mature, well formed low columnar type, in acinar or partial acinar and tubular formation. These groups were separated by a fine fibrous stroma. The round cells, like those seen in lymphosarcoma were malignant in appearance but separated into small islands by dense fibrous tissue. In some sections neither epithelial nor round cells were seen; dense fibrous tissue was the only structure.

Irradiation established regression in all of the seven Wilms' tumors. This was followed by transperitoneal nephrectomy. The immediate postoperative results were very encouraging. It was hoped that preoperative irradiation would improve the end results in the treatment of these tumors. There were no operative deaths. The immediate

convalescence was uneventful. But the follow-up studies revealed they had all died within 3½ years after operation. Six of the children died from metastasis and one from persistent anemia.

There is no question that preoperative irradiation established regression which facilitated subsequent surgical removal. It is also possible that preoperative irradiation prolonged life. In Priestly and Broders (15) (16) series of cases, the average duration of life after nephrectomy alone was 7.1 months, while it was 12.5 months after irradition and nephrectomy. The cases in our series and those available in the literature indicate that preoperative irradiation does give a temporary prolongation of life, but the end result is still utterly bad.

There are a few reported cases living and doing well after surgical removal. Most of these have been tabulated in table 4.

TABLE 4.—*Post operation Survival Series*

Author	Year	Number	Length of time living and well	Author	Year	Number	Length of time living and well
Kretschmer and Hibbs	1931	1	1 year+.	Israel	1894	1	1 year.
Campbell	1934	2	2 years+.	Schmidt	1892	1	4 years.
Coley	1935	1	29 years.	Loughnane	1923	2	2 years+.
Mixter	1932	1	12 years.			4	3 years.
Do		1	6 years+.	Counsellor, Fox, etc	1933	1	1 year+.
Do		2	3 years+.	Prather and Crabtree	1931	1	1 year+.
Do		1	2 years.	Ladd	1938	1	7 years+.
Robbins	1924	1	1 year+.	Do		1	10 years+.
Wollstein	1927	1	34 years.	Do		1	19 years+.
Do		1	6 years.	Do		1	3 years.
Do		1	1 year.	Do		2	1 year+.
Schiffers	1924	4	4 years+.	Do		1	4 years+.
White	1931	1	7 years.	Do		1	13 years+.
		1	4 years.	Do		1	10 years+.
Abbe	1912	1	20 years.	Do		1	5 years+.
Deming	1923	1	1 year+.	Do		1	6 years+.
Magonn and McCarty	1923	1	1 year+.				

It is important to realize that most of the cases tabulated have not been followed sufficiently long to safely consider them cures. Recurrence and metastasis have been reported 10 years after surgical removal of the mixed tumor. With this possibility in mind the most skeptical analyst would accept but 8 of 44 reported cases. The most important deduction from this study is that the 8 cases which are probably sure cures have never had preoperative or postoperative irradiation. Although the author has been an advocate of preoperative irradiation as suggested by Randall (21) an analysis after the test of time has caused a definite change of opinion.

MECHANISM OF IRRADIATION

The mechanism of irradiation regression of tumors still lacks complete understanding. The accumulated information leaves us with two views, one direct action upon the cells, the other indirect action, the result of vascular changes. Pullinger (22) described the early

changes of hyperemia and injury to the endothelium of thin-walled ill-supported vessels. This injury results in edema, desquamation of cells at the surface, thrombosis, infarction, necrobiosis, exudation of serum, coagulation, extravasation of blood and trauma. Fernau emphasizes injuries to vessel walls and cell membranes increased permeability of vessel and cell walls, alterations in hydrogen ion concentration and osmotic pressure, changes in the rate and character of diffusion between blood and tissues, variations in surface tension; viscosity and changes of tissue colloids, flocculation of albumin, lipoid complexes, oxidative disturbance and disturbances in other chemical processes. Ewing (6) stated that in tumors, irradiation is followed by enormous swelling and hyperchromatism of epithelial nuclei, the result of inhibition of fluid by the nuclei at the expense of the cytoplasm. From these and many other observations, it can be seen that in spite of all efforts there is still uncertain knowledge about the actual mechanism of ray action.

Although the accumulated evidence indicates a dual activity upon sensitive tumors, there is one definite deduction available. The description of the microscopic changes of tumors at different stages of irradiation are all in accord with trauma. The acceptance of this view prompts the thought that irradiation trauma predisposes to dissemination of cells by way of the blood or lymph stream. This may be the reason for the latent metastasis after extensive regression of mixed tumors of the kidney.

After an extensive review of the literature and a personal analysis of seven cases of mixed tumor of the kidney, the author is in accord with Ladd (20) who points out that in dealing with such rapidly growing tumor, immediate removal seems to offer a better chance of cure than nephrectomy delayed by preliminary irradiation.

CONCLUSIONS

1. The pathological studies and clinical studies indicate that preoperative irradiation of kidney tumors should never be advised except for palliation.

2. Roentgen therapy should only be used when surgical removal cannot be accomplished.

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AIRSICKNESS DURING ACROBATICS[1]

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During the past 10 months while assigned to duty as naval flight surgeon for the cadet regiment at a United States naval air station, I have had the opportunity to see a great many cadets suffering from airsickness. Isolated cases occurred in practically all stages of instruction, but in general, most cases were noted during the period of acrobatics.

Airsickness is a syndrome producing sweating, pallor, nausea, and vomiting. These symptoms occur primarily while in the air, but have developed after the flight has been completed.

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As early as 1917, those in aviation medicine realized that two of the major medical problems connected with flying were the understanding of the vestibular sense, that is, whirling, airsickness, and blind flying, and the problem of oxygen deficiency. Therefore, a great deal of research was done in order to establish the manner in which one orients himself in space.

Of the five senses, those of touch, taste, and smell give us little to no information as to our position in the air. This leaves only the eye, the ear, and the proprioceptive, or muscle, joint, and tendon sense. It is the latter which the pilots speak of as the "feel of the seat," and upon which older pilots depended so much.

The neurological relationship between the eye and the vestibular apparatus is through the medial longitudinal fasciculus which extends from the floor of the third ventricle to the spinal cord. A large portion of the fibers of the medial longitudinal fasciculus are derived from the vestibular nuclei. From this origin, the fibers pass through the reticular formation to the medial longitudinal fasciculus of the same or opposite side. The majority of the fibers turn either up or down to become ascending or descending fibers within the fasciculus. The former terminate in the nuclei of the oculomotor, trochlear and abducens nerve, the latter in the nucleus of the spinal accessory nerve and in the columna anterior of the cervical portion of the spinal cord. In this way there is established a path for the reflex control of the movement of the head, neck, and eyes, in response to stimulation of the nerve endings in the semicircular canals of the ears. Hence, the dorsal longitudinal bundle is chiefly engaged in maintaining muscular synergy, or the coordination and cooperation necessary for a correct appreciation of our position in space.

During any movement of the body, the vestibular apparatus sends impulses to the brain. During continued or violent movements of the body, a great many impulses are received by the brain. When the vestibular apparatus becomes overstimulated, and the brain can no longer interpret these impulses properly, the person soon becomes nauseated, and vomits, and he is said to be airsick, carsick, or seasick, depending on the agent producing the movements. The same condition can be produced by overstimulation of the vestibular apparatus by irrigating the ear with very cold water, or by spinning in the Barany chair. Therefore, it becomes imperative that a person interpret these sensations properly or ignore them in part in order to prevent airsickness.

Through the neurological relationship of medial longitudinal fasciculus described above, impulses from the eyes can modify the im-

pulses from the vestibular apparatus. So, as long as a person can orient himself in space by visual means, he can ignore or modify impulses coming from the vestibular apparatus.

During blind flying when the eyes can no longer tell the pilot of his position in space, even the most experienced of pilots have the sensation of vertigo even to the point of nausea and vomiting. Therefore, it is necessary that they depend entirely upon their instruments to tell them that the sensations received from the vestibular apparatus are false.

The same holds true, in most cases, for the student engaged in acrobatics. Because of the short number of hours they have spent in the air, these students try to do the various acrobatic maneuvers in a purely mechanical way, and are never oriented in space as to the position of the airplane in relation to the earth. Until they properly learn to use their eyes to tell them their position in relation to the earth, and thus modify the impulses from the vestibular apparatus, they become sick.

This can be brought out very strikingly in other instances. Everyone is acquainted with the frequency with which people become carsick. However, it is usually the person riding in the rear seat of the car who becomes sick, and rarely, if ever, the driver of the automobile. The driver must watch the road and continually use his eyes to orient himself, thus ignoring the vestibular impulses. The passenger is not required to follow the road so closely, and becomes sick.

A parallel example can be cited in the case of dancers who spin about time after time and still maintain perfect balance. The ordinary person spins a few times and becomes dizzy. Dancers soon learn that by watching a point on the wall they can spin without producing vertigo.

It is well known that people who are seasick feel a great deal better on the weather deck of a ship than in a room below deck. While on deck they naturally look at objects away from the ship, such as the horizon, land, and other vessels. Through this means they orient themselves by the use of their eyes, and ignore many of the vestibular impulses.

In consideration of this high relationship between the eye and the ear as regards one's orientation in space, a regular routine as on page 905 was carried out with each student who reported to sick call complaining of airsickness; the whole plan revolving around the one idea that the student must properly orient himself in space by the use of his eyes to prevent airsickness.

The student was first asked the stage of training he was engaged in at the time the airsickness was first noted. In practically all cases it was found to be that of acrobatics. In the vast majority of cases it was found that the sickness occurred near the end of the first hour of

the initial flight on that stage of training. During successive flights of about the same duration the student became so ill that he could absorb no more instruction, or, if soloing, so ill he would no longer try the stunts. The student was then told to carry out the following routine on the next scheduled flight:

1. To adjust the seat to a high position in the plane so visibility would be at the maximum. Each man was cautioned to be certain that full throw of the rudder paddles was possible after adjusting the seat to this high position.

2. To fasten the safety belt as firmly as possible. This was done in order that the proprioceptive sense would be at its best, as all seat movements would be felt in a firm but smooth manner.

3. To keep his eyes out of the cockpit at all times except for casual glances at the instruments. It was found that practically all students had the tendency of "looking" the controls through on maneuvers during instruction rather than "following" or "feeling" the controls through as instructed. In "looking" the controls through, their eyes were continually in the cockpit and they had practically no idea as to the position of the airplane in relation to the earth. Due to this fact, it was found that nearly every student felt better when he was either soloing, or flying the plane with the instructor present, as in these cases he was forced to use his vision more to keep oriented.

The fact that the students felt better while soloing also tends to disprove the often mentioned statement that airsickness is due to a fear reaction.

4. To pick out some point of reference a long way from the airplane. This is by far the most important item told the student. In executing a loop, a point on the ground should be watched on the initial nose-over, and after the top of the loop has been reached, a point on the horizon should be selected and the airplane brought down in alignment with this point; additional points being selected as needed for points of reference. The same procedure was used in an Immelmann turn. In spins, points of reference on the ground should be followed at all times, and the eyes should never be fixed on the nose or wings of the airplane. This is essential in doing precision spins, as otherwise the student has little idea where to begin recovery in order to stop the spin at the desired point. In the performance of "wing-overs" he was advised to do the maneuver relative to a straight stretch of road, fence line, or similar object whenever possible. It was found that most students who became airsick during this maneuver spent a great deal of time looking in the cockpit at the air-speed meter, and the "needle and ball" indicator, literally flying mechanically by instruments with no points of reference on the earth's surface ever being used. In snap rolls, a point on the horizon or a cloud bank could be taken as a point of reference. This point can be followed during the maneuver and the student will know his position throughout the roll.

5. To not try the same type of maneuver over and over again, as this tends to cause airsickness to a far greater extent than if they vary them, and to wait a short interval between different acrobatics.

6. To never attempt to land an airplane if he is extremely airsick, as it is much safer to stay at a reasonable altitude until the airsickness has subsided.

In no case was any mention made of diet or any type of medication used.

During the 10-month period ending January 1, 1942, a large number of students have undergone flight training at this station. Of this number, an average of 18 students per month were treated by the author

for airsickness with satisfactory results. Five students have been dropped from flight training because of airsickness, only one of whom was treated as outlined above. This one student gave a history of previous car sickness, train sickness, and swing sickness, and his training was discontinued prior to the acrobatic stage.

CONCLUSIONS

1. That there is a close neurological relationship between the vestibular apparatus and the eye; therefore, the eye can be used to modify impulses coming from the vestibular apparatus.

2. That airsickness is a frequent finding among student pilots, and if not properly treated can be the cause of their failure to make satisfactory progress in flight training.

3. That airsickness in most students during acrobatics is caused by their poor orientation in space. Airsickness can ordinarily be overcome when a student becomes oriented in the air by using his eyes to pick up points of reference on the ground.

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RENAL FAILURE COMPLICATING MUSCLE CRUSH INJURIES [1]

By Lieutenant, junior grade, P. H. Futcher, Medical Corps, United States Naval Reserve

The German bombings of England have furnished physicians and physiologists with many problems, not the least stimulating of which is investigation of the renal insufficiency which may complicate injuries to the extremities. The first reports (1) (2) (3) (4) (5) on this "muscle crush syndrome" in March 1941, and subsequent descriptions of similar cases in the English journals, may be outlined as follows.

A bombed house collapses about an occupant, and a heavy beam falls across an upper arm or thigh. Five to 15 hours later the victim is extricated from the wreckage and transferred to a hospital, where he arrives with severe bruises of one or more extremities and often in shock. Immediate administration of whole blood or plasma restores blood pressure to normal, and the patient's condition appears satisfactory. However, during the succeeding 24 hours a brawny edema develops in the traumatized extremity. The urine, which contains albumin, granular casts, and often blood, is scanty. The patient be-

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comes drowsy, then comatose, and sometimes generally edematous. The blood pressure may be elevated above normal. Following admission the blood urea rises steadily to uremic levels; the serum potassium also rises, and the serum carbon dioxide combining power falls, as may the serum chloride. The patient succumbs a week after the accident. At autopsy, the renal tubular cells show evidence of damage (6) (7), and striking accumulations of a brownish material are found in the tubular lumens. The traumatized muscles are edematous and sometimes paler than normal.

After initial suppression of urine, improvement of renal function and subsequent recovery are sometimes observed. There are no data as to the frequency with which this form of uremia complicates injury to muscles. There are indications that occlusion of the arteries supplying an extremity may also precipitate renal insufficiency in the absence of direct trauma to the muscle.

The pathogenesis of the syndrome is not clear. The similarity of the renal lesions to those observed following blood transfusion reactions is agreed upon. Some observers believe that many of the reported cases are simply examples of a hemolytic reaction following administration of incompatible blood or plasma. Others feel that the kidney is damaged by circulating myohemoglobin released from the traumatized muscles; myohemoglobin has been observed in the urine of patients suffering from muscle crush syndrome (8). Potassium may also escape from muscles to blood stream and cause symptoms of toxicity. Other suggestions are that the renal insufficiency is secondary to long-sustained circulatory shock, or to the passage of fluid and electrolytes into the damaged limb. A satisfactory method of treatment awaits adequate elucidation of the syndrome by a subcommittee of the Medical Research Council and several other groups of investigators in England and America.

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PERFORATED PEPTIC ULCER [1]

By Lieutenant, junior grade, John H. Crandon, Medical Corps, United States Naval Reserve

Perforated peptic ulcer is an emergency wherein an otherwise likely fatality may be averted in the great majority of cases by early diagnosis and proper surgical treatment. Using modern methods, the mortality in this condition should be well under 10 percent in a well-organized unit such as the Navy. Whereas, a decade or so ago, fatalities were frequently due to shock, peritonitis, subphrenic and pelvic abscesses, reperforations, intestinal obstruction, wound sepsis with dehiscence, and aspiration pneumonia, deaths from perforated peptic ulcer today should be quite rare, and due to such complications as pylephlebitis, pulmonary embolus, and intercurrent pneumonia.

DIAGNOSIS

Although the diagnosis of perforated peptic ulcer is generally a simple matter, in some cases this surgical emergency may be difficult to differentiate from certain other conditions. Easily to be confused with it are certain cases of early acute appendicitis, coronary or mesenteric thrombosis, acute pancreatitis or cholecystitis, acute alcoholic gastritis, and, less frequently, biliary or renal colic. Other conditions rarely simulating perforated peptic ulcer, such as tabetic crises, dissecting aneurysm, diaphragmatic hernia, perforated gastric carcinoma, pylorospasm, lead colic, and poisonings are hardly worthy of consideration. A history of trauma should give the lead to conditions such as ruptured liver, spleen, duodenum, or other viscus, the physical findings of which may closely simulate those of perforated ulcer.

In making the diagnosis of perforated peptic ulcer, an important point to consider in the history is the character of onset of the pain and its severity. The suddenness of the pain is almost invariably extreme, being paralleled in this respect, and also in respect to its severity, only by the pain of coronary occlusion. The patient can generally remember exactly what he was doing at the time of the pain's onset, first, because of its extreme suddenness; and secondly, because he is incapacitated directly thereafter. The mode of onset of the pain may be the main clue for differentiating a perforated ulcer from an explo-

sive type of acute cholecystitis. The character of the pain is also of importance, since in perforated ulcer it is almost invariably steady, as opposed to the colicky type of pain seen in biliary or renal calculus.

Another point worthy of consideration in the present illness is the degree of vomiting. As a rule, patients with perforated peptic ulcer vomit very little, if at all, until they are on the operating table and passing through the second stage of an inhalation anesthesia. This is in marked contrast to most cases of acute pancreatitis, in which the vomiting is severe and prolonged, owing to the proximity of the pancreas to the celiac plexus.

Among the outstanding features of the physical examination, the diathesis of the patient is of first importance. The lean, wiry, active, youthful or middle-aged male is the type most frequently subject to this abdominal catastrophe.

Palpation of the abdomen for the first 12 or 15 hours after the perforation will almost invariably reveal marked generalized tenderness and spasm, the anterior abdominal wall being generally board-like. In a few cases where there has been only a small amount of spillage from the ulcer, and this down the right gutter, the tenderness may closely parallel that of certain cases of early acute appendicitis of an explosive type, but maximal tenderness is apt to be in the right upper rather than the right lower quadrant. In early acute pancreatitis the extreme tenderness and rigidity is generally confined to the upper abdomen, and extends well into the left upper quadrant.

It should be remembered that as the 24th hour is approached following the perforation of a peptic ulcer, considerable relaxation of the abdominal wall and lessening of the tenderness may occur. Such abdominal findings are also occasionally to be found in elderly or debilitated individuals from the very onset, and are apt to be misleading. Rebound tenderness and, also, pain on cough may be of aid in establishing the diagnosis of peritonitis.

Of prime importance is auscultation of the abdomen, since, if there is any appreciable spillage of gastric contents into the abdominal cavity, it will be invariably silent. This is in contrast to early appendicitis or pancreatitis, and to coronary thrombosis and other extra-abdominal conditions, in which peristalsis is practically always present, although perhaps considerably diminished. In this regard, the hearing of breath sounds in an otherwise silent abdomen is a valuable sign for corroborating the suspicion of the presence of peritoneal exudate.

Determination of the blood pressure, which should be done soon after the patient is first seen in order that shock may be detected and adequately treated, may also be of some value in helping to establish a diagnosis. Although a small drop in pressure is frequently found

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with a perforated ulcer, a low systolic pressure (90 mg. or lower) occurring soon after the onset of symptoms is suggestive of coronary occlusion or acute pancreatitis, the former condition being frequently associated with a tachycardia, and the latter, frequently, with a brady-cardia.

The urine should, of course, be tested for sugar to rule out incipient diabetic coma, and, if the reagent is available, a diastase may be run on it to help rule out pancreatitis.

A flat plate of the abdomen with the patient in a sitting position may make a positive diagnosis, if air is present under the diaphragm, but does not rule out perforated ulcer if negative. If there is a ques-tion of coronary occlusion and the facilities are available, an electro-cardiogram may be of value.

If, following a summation and evaluation of all findings, there is still doubt as to the correct diagnosis, exploration, preferably through a right rectus incision, is the only alternative.

PREOPERATIVE PREPARATION

Once the diagnosis is established, and after coronary thrombosis, particularly, has been satisfactorily ruled out, an intravenous infusion of 5-percent glucose and saline should be started routinely. Propef premedication, such as $\frac{1}{6}$ gr. of morphine or 4 gr. of sodium luminal, and $\frac{1}{100}$ gr. of atropine, should be given. Following this, the stomach contents should be painstakingly and completely aspirated by means of a Levin tube. This step is of great importance, since the patient with a perforated peptic ulcer frequently vomits large amounts during the induction of anesthesia, if it be of the inhalation type, with the ensuing possibility of an aspiration pneumonia. In the past, with the routine use of ether anesthesia in this type of case, aspiration of vomitus during induction was a common cause of subsequent fatality, particu-larly in the hands of inexperienced anesthetists.

Today, unless the blood pressure is so low as to contraindicate it (below 100 systolic), spinal anesthesia may be employed to great ad-vantage. The fall in blood pressure which frequently occurs follow-ing the use of this type of anesthesia may be easily combated by the intravenous saline which should be routinely running in these patients before such procedure is started. For the average-sized adult male in good condition, a combination of 100 mg. of novocaine and 10 mg. of pontocaine in 3 cc. of spinal fluid, or 18 mg. of pontocaine in 3 cc. of 10-percent glucose, injected slowly through the second or third lumbar interspace, should give a level of anesthesia slightly above the costal distention and shock may be combated to a considerable degree by eral condition otherwise gives rise to concern, a smaller dose of spinal, supplemented by intravenous pentothal or evipal, may be employed to

great advantage. Such procedure may indeed be lifesaving in a situation where there is no skilled anesthetist available.

As precautionary measures, some type of gas machine, connected to oxygen, and a syringe containing epinephrine, should always be present in the room during a spinal anesthesia; and the blood pressure should, of course, be determined at frequent intervals.

<center>OPERATIVE PROCEDURE</center>

Because the perforation is almost invariably just proximal or distal to the pylorus, and on the anterior surface, either an upper right rectus or an oblique right subcostal (Kocher) incision should be employed. Contrary to what might be expected, the most important point about the incision is that it be large enough to admit a hand into the peritoneal cavity. Careful draping of the wound margins with skin-towels and Mikulicz pads is generally not required, since a most important factor in this operation is to get in and out relatively rapidly.

Once the peritoneal cavity is opened the perforation should be attacked at once. Although it is generally readily visible on the anterior surface of the pyloric region or first part of the duodenum, it is occasionally hidden by the under surface of the liver. In this case it can be readily brought into the field by grasping the greater curvature of the stomach with two or more Babcock clamps, and employing gentle traction downward. In a few cases the perforation will lie on the posterior surface of the stomach. In this event it may be approached by making an incision through the gastrocolic omentum, as for a gastric resection. If this is done great care must be taken to avoid the middle colic artery. In closing, moreover, one should always remember to sew up this rent in the gastrocolic omentum to prevent the possibility of subsequent internal hernia. In the rare event that no perforation can be located despite the presence of gastric contents in the abdominal cavity, it is permissible to have the anesthetist inject some methylene blue in sterile saline through the Levin tube, in an effort to find the source of the leakage.

Although there may be some difference of opinion on this point, it is generally agreed that the best method of closing the perforation is that prescribed by Graham (1). By this method a piece of omentum, preferably but not necessarily viable, is sutured over the perforation by several interrupted sutures of G. I. (atraumatic) catgut. No attempt is made to close the perforation itself. The advantages of this method are, first, that it is simple and timesaving; and second, that it results in a sound closure in all cases. If an attempt is made to close the perforation by a purse-string or other type of suture, it will be frequently found that the tissue around the ulcer is so friable that the sutures pull through, either at time of operation or subsequently,

because of the tension necessary to close the perforation. Moreover, suturing by such methods not infrequently causes so much inversion of the stomach or duodenal wall at the site of suturing that obstruction of the pylorus results, with subsequent blowing out of the suture line.

Following closure of the perforation, the abdominal cavity should be thoroughly aspirated of all gastric contents. This treatment is in marked contrast to the now antiquated procedure of merely stuffing several drains into the abdominal cavity. Particular care should be taken to remove gastric contents and pus which may be pocketed between the right lobe of the liver and under surface of the diaphragm. In order to free material which may have accumulated in this region it is necessary to introduce a hand through the wound and into the abdominal cavity, sweeping it gently over the dome of the liver between this organ and the diaphragm. This movement will introduce air into this area, allowing any pocketed fluid to spill into the abdominal cavity, from whence it may be aspirated. This maneuver may be repeated a few times to advantage and will greatly lessen the possibility of a subsequent subphrenic abscess. The suction apparatus, which for this purpose is ideally a tube with multiple perforations, should be introduced gently into both subphrenic spaces and also into the pelvis, where it may aspirate a considerable amount of fluid lying in the pouch of Douglas.

Following thorough and complete aspiration of the abdominal cavity, approximately 4 gm. of sulfanilamide may be introduced, and depending on the judgment of the operator, the abdominal cavity may be closed without drainage. Experienced surgeons are coming more and more to the conclusion that if the focus of spillage is eliminated, and a careful mechanical cleansing of gross contamination carried out, the peritoneal cavity can take care of considerable bacterial or chemical insult, to a much better degree, indeed, than can the tissues of an abdominal wound. In general, only those cases should be drained in which there is either a localized abscess, or in which it is impossible to remove all the gross contamination.

In such cases a frequently ideal site of drainage is the region of the foramen of Winslow, carrying the drain out through a stab wound in the right flank under the costal margin. Although the wound may be closed satisfactorily by a great many different methods, one measure of prime importance, the use of stay sutures, should never be omitted. In all cases numerous stay sutures of silk or wire should be placed, before the fascia is closed, being carried down preferably through fascia to peritoneum. The danger of dehiscence, which is considerable in these cases, is thereby largely avoided.

A small slip of rubber dam may be placed down to the peritoneum following its closure to take care of the possibility of wound sepsis.

Following closure of the peritoneal cavity, it is also frequently advisable to irrigate the wound thoroughly with several hundred cubic centimeters of sterile saline, sponge dry gently, and sprinkle about 1 gram of powdered sulfanilamide into it before closure.

In cases where it is urgent that the operation be concluded rapidly, or where the anesthesia is insufficient or wearing off, it is frequently good judgment to employ numerous strong through-and-through stay sutures through all layers, including peritoneum, as the only means of closure.

POSTOPERATIVE CARE

Today it is agreed that a modified Ochsner regime is the best postoperative treatment for cases of perforated peptic ulcer. Most important is constant Wangensteen suction through the Levin tube passed prior to operation. Care must be taken that this tube does not become plugged, whereby gastric secretions may be allowed to collect in the stomach and possibly blow out the sutured perforation. The length of time the tube should be kept in place will vary considerably with different surgeons, but a minimum of 3 days should be allowed for the edema around the pylorus to subside and for peristalsis to return to normal. A good time for removal of the tube is not only after normal peristalsis is evident by abdominal auscultation, but also after it has been definitely established that the patient can tolerate fluids by mouth.

Following return of normal peristalsis therefore, and not before the third postoperative day, the patient should be started off cautiously on fluids by mouth, with the Wangensteen apparatus clamped off. During the first day he should be allowed only an ounce or so per hour, and, very important, the tube should be aspirated at the end of the day to make sure that there is not a large residual in the stomach which might have a deleterious or disastrous effect on the suture line over night. The following day the amount per mouth can be doubled, and the next day trebled, with aspiration of the stomach being carried out at the end of each day for residual. If there is no residual at the end of the third day, it is undoubtedly safe to remove the tube and start the patient on a bland ulcer diet.

Over this immediate postoperative period the patient should be kept in high Fowler's position, and his fluid imbalance, as measured by output in Wangensteen and urine, should be corrected by ample quantities of intravenous saline and 5-percent glucose. Morphine should be given somewhat sparingly, since large amounts will predispose to atelectasis, which must be constantly watched for, particularly at the right base. In severe cases, where there is considerable peritonitis,

distention and shock may be combated to a considerable degree by giving the patient constant 100-percent oxygen by means of a Boothby mask (2).

Chemotherapy may be administered by vein, but it should be remembered that if any quantity of the drug was placed in the peritoneal cavity at the time of operation this will result in a high blood level for the first 24 to 48 hours postoperatively, so that caution should be taken in giving more of the drug during this time.

Immediately after operation the patient should be started on parenteral vitamin C, since most of the cases of this type are severely lacking in this vitamin, a lack of which, if left uncorrected, may result in dehiscence of the operative wound, blowing out of the sutured perforation, or both. A satisfactory dosage of this vitamin in these cases will be 1 gram, intravenously, daily for 5 days.

If a slip of rubber dam was placed in the lower end of the wound at operation, this should be removed on or about the third postoperative day, unless there is evidence of wound sepsis at this time. Under no circumstances should the stay sutures be removed before the fourteenth postoperative day; if sepsis is present, it may be wise to keep them in place for a considerably longer period to avoid wound dehiscence.

Once the patient has recovered, it is, of course, important to follow him closely from the point of view of watching his diet and frequently checking his upper gastro-intestinal tract by x-ray. A considerable number of these cases will come to further surgery, necessitated by chronic pyloric obstruction, or ulcer, or both.

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TREATMENT OF ACUTE PHARYNGITIS AND TONSILLITIS WITH AND WITHOUT SULFA DRUGS [1]

By Lieutenant Ashton Emerson, Medical Corps, United States Navy

The statistics were obtained from cases admitted to the sick bay of a battleship during a 4-month period. Seventy-seven individual cases were followed.

Diagnosis was established directly on history and physical examination. Smears and darkfields were used only to rule out other diseases. A typical case would run as follows:

The history was characterized by the sudden onset of a sore throat accompanied by difficulty in swallowing and generalized malaise. In the interval of a day before these patients would report to the sick bay, these complaints would grow progressively worse. Physical examination in the tonsillitis cases would reveal swollen, red, tender tonsils, markedly injected and covered with a grey-white, patchy, fibrinopurulent exudate mixed with detritus lying in the crypts. An almost characteristic heavy obnoxious odor was likewise noted in most cases. The pharyngitis cases were very similar, if not indistinguishable, and the pharyngeal lymphatic tissue presented a corresponding picture. In certain cases no sharp differentiation might be made and the two conditions could be said to coexist.

Gram stains were not done in all cases, but in those patients in which smears were done they revealed gram-positive cocci in chains and clusters morphologically resembling the streptococci. No cultures were made. Absolute bacteriological identification was not established; however, no cases of Vincent's angina were included. Similarly, no cases in which upper respiratory symptomatology was predominate preceding the infectious exanthemata, sinusitis, otitis, or rhinitis are included.

The average age was 19 years, 11 months, and 24 days. The mean proportion for length of service was 1 year, 7 months, and 10 days. These patients had an average admission fever of 101° F. Almost without exception, they were discharged to duty the morning after a day of normal temperature. The only complications of note were two cases under symptomatic treatment which developed peritonsillar abscesses and were retained in the sick bay for 3 and 6 days respectively. Only one luetic is included in this series.

The treatment consisted of bed rest and a normal diet. When difficulty in swallowing was severe, the patients received fluids or soft food. A saline gargle was given three times a day. Acetylsalicylic acid (aspirin) and codeine were furnished for severe discomfort or pain. One group was treated with a merthiolate swab, topically applied twice a day, called symptomatic in the analysis; the other received either sulfanilamide grs. 14 q. i. d. or sulfathiazole in similar doses as indicated in the statistics. No complications in the use of the sulfa drugs were noted with the exception of mild nausea or vomiting, and such subjective complaints as vertigo in a small percentage of the cases. Sodium bicarbonate grs. 10 was given with each dose of sulfanilamide.

Table 1 gives the statistics on cases of acute tonsilitis and pharyngitis admitted during the 4-month period.

TABLE 1.—*Case Treatment Statistics*

Treatment	Number of cases	Average days per case
Tonsillitis, acute:		
Sulfanilamide	25	4.04
Symptomatic	29	3.72
Pharyngitis, acute:		
Sulfanilamide	6	3.00
Sulfathiazole	4	4.50
Symptomatic	13	3.62
Combined cases:		
Sulfa drugs	35	3.90
Symptomatic	42	3.72

CONCLUSION

The average case of acute pharyngitis and tonsillitis is not affected in its course by the sulfa drugs. The use of these should be restricted to severe cases and only with specific indications such as otitis media, acute sinusitis, pharyngeal or peritonsillar absecess; and then only as an adjunct to surgery.

CONSERVATION OF RUBBER GLOVES BY CHEMICAL STERILIZATION [1]

STUDY OF EFFICACY OF CHEMICAL STERILIZATION AND COMPARISON OF THE EFFECTS OF HEAT AND CHEMICAL STERILIZATION UPON RUBBER GLOVES

By Lieutenant Commander K. P. A. Taylor, Medical Corps, United States Naval Reserve

The present investigation was prompted by the desire to determine whether chemical sterilization of gloves is less destructive than heat sterilization, and, in this case, to perfect a practical, safe method of chemical sterilization, eliminating the autoclave and electric sterilizer.

Sterilization by antiseptics to prolong the life of gloves has been used on the continent for many years. The pioneer in this field was probably Demmer (1) who practiced a "plan for economizing rubber gloves." I am indebted to Engler (2) for the following description of the Demmer procedure:

There are four reasons for the wearing out of rubber gloves, submitted in the order of their importance:

1. Dry or moist heat.
2. Uneven wear caused by improper fit.
3. Damage by sharp instruments.
4. Reckless handling and indifferent care of gloves.

(The writer would include age as a major cause of rubber deterioration, and add friction from use or wear, and the effect of light and chemicals.)

Demmer had every scrubbed person in the operating room issued 6 new pairs of rubber gloves, for which he was responsible, and which he kept in his own locker. All personnel were carefully fitted; a nurse was not allowed to wear a large, loose glove, nor could doctors unduly stretch gloves in putting them on.

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Puncture of gloves was lessened by abolition of pointed scissors, and limiting toothed forceps to the skin. Each person's gloves were marked indelibly with his name.

The Demmer technic of preparing for operation follows:

The hands (only) are washed with soap and water for 2 minutes, dried with a clean towel, and powdered. The individual nonsterile gloves are taken from their lockers and placed on the hands. The gloved hands are then washed with sterile brush, soap and water for 5 minutes (the cuffs included). Do not allow water to splash on gloves from unsterile forearms or wrists. The gloved hands are then soaked to the top of the cuffs in bichloride of mercury 1:2000 solution for 5 minutes. A sterile gown is put on, allowing the sleeves to fall on the outside of the glove cuffs. (The sleeves cannot be tucked into the gloves; in doing so, the unsterile wrists would be touched). The sleeve margins are tied around the cuffs of the gloves with pieces of sterile (boiled) bandage cut for this purpose. Boiled white cotton gloves are next put on over the rubber gloves. Thus equipped, the surgeon operates.

After operation, the rubber gloves are inspected for holes. Undamaged gloves are washed with soap and water, placed in bichloride of mercury 1:2000 solution for 1 hour, dried on both sides, dusted, and returned to their lockers (unsterile). If a pair of gloves is discarded, a new pair is requisitioned, and placed in the locker. Punctured gloves are repaired and used for examinations and septic surgery.

In case of puncture during operation, operator discards both cotton and rubber gloves and gown, and prepares himself anew. This is an extremely rare occurrence.

Results of Demmer technic: The gloves are effectively sterilized for operating; wound infections are not increased; the life of the gloves is extended about 500 percent.

COMMENT ON DEMMER TECHNIC

From his own experience, the writer is confident that gloves prepared in this manner are indeed sterile, and that the technic can be relied upon. A number of disadvantages are apparent:

1. Only the outside of the glove is sterilized.
2. The hands are not fully scrubbed.
3. The forearms and wrists are not scrubbed at all.
4. The sleeve of the gown must be tied outside the cuff of the glove.
5. This arrangement permits perspiration from the unscrubbed arms to reach the outside of the glove.
6. Scrubbing the gloves with a brush is a major wear factor.
7. Is it certain that the white cotton gloves greatly reduce wear on the rubber gloves? The "saving" effect of the cotton gloves upon the rubber gloves may be important; it is not investigated in this study.
8. Many surgeons are unwilling to devote 10 minutes to the preparation of each pair of gloves used in an operating day.

DETERIORATING EFFECT ON RUBBER GLOVES OF HEAT STERILIZATION AND CHEMICAL STERILIZATION

The selection of chemical antiseptics was derived from the experience of Spaulding (3), whose study of chemical sterilization of surgical

instruments is referred to (4). Spaulding showed that the listed disinfectants killed all of the important pathogens in from ½ to 10 minutes exposure: borax-formalin solution, 95 percent phenol, 5 percent cresol, formalin-alcohol, metaphen 1:2500 aqueous and alcohol 70 percent. Of these solutions, borax-formalin and formalin-alcohol both destroyed spores of Bacillus anthrax, Clostridium welchii, and Clostridium tetani in 18 hours; the other failed to kill spores in that period.

The most effective germicides against nonsporulating bacteria were phenol 95 percent, metaphen 1:2500 aqueous, formalin-alcohol (Bard Parker solution) and 70 percent alcohol. All of these killed pathogens in from ½ to 2 minutes.

For the glove resistance tests, the following were selected: mercuric chloride 1:1000 aqueous solution replaced metaphen because of its greater availability; borax-formalin (sodium tetraborate (borax) 5 percent, formalin 10 percent in water); and formalin-alcohol (formaldehyde 8 percent, methyl alcohol 9.3 percent, ethyl alcohol 67.8 percent); and alcohol 70 percent in conjunction with these.

Gloves were washed with soap and water for 5 minutes, then immersed for 2 minutes each in bichloride 1:1000, followed by alcohol 70 percent for 2 minutes; in borax-formalin and in alcohol for 2 minutes each, and in formalin-alcohol and in alcohol for 2 minutes each. This procedure was enacted daily for 15 days. Other gloves were autoclaved at 15 pounds pressure, 15 and 30 minutes daily, for 15 days. At the end of the test period, gloves were strength tested, and their breaking weight recorded (table 1). Other gloves were soaked continuously for 15 days in the named solutions, and still others subjected to constant boiling for 15 days.

TABLE 7.—*Effect of heat and chemical sterilization on glove strength*

Procedure	Breaking strength (range)		Breaking strength average	
	Pounds	Kilograms	Pounds	Kilograms
Autoclave 15 days for 15 minutes	11.50-15.00	5.2- 6.8	13.2	6.0
Autoclave 15 days for 30 minutes	9.00-11.50	4.0- 5.2	9.3	4.2
Bichloride-alcohol scrub for 15 days	26.75-31.00	12.3-14.6	28.8	13.1
Formalin-alcohol scrub for 15 days	17.50-26.75	8.0-12.3	22.1	10.0
Borax-formalin scrub for 15 days	21.75-31.50	9.9-14.3	26.6	12.0
Bichloride soak for 15 days	24.00-26.75	10.9-12.3	25.3	11.5
Formalin-alcohol soak for 15 days	22.00-23.00	10.0-10.4	22.5	10.2
Borax-formalin soak for 15 days	19.00-23.00	8.6-10.4	21.0	9.5
Boiled 20 minutes daily for 15 days	19.00-26.75	8.8-12.3	22.8	10.3
Boiled constantly for 15 days	1.00- 4.50	.45- 2.0	2.7	1.2

Gloves used in these tests were newly taken from the district medical storeroom. It was apparent that there were marked differences in tensile strength of some "new" gloves of the same make. These differences were probably due to difference in date of manufacture. Ross (4) has advised that manufacturers date and vacuum-pack rub-

ber gloves. Marked loss in strength occurs from aging, particularly in the tropics. Vacuum packing would definitely minimize this deterioration. Because of these factors, and other restrictive conditions under which the experiments were conducted, the results in figures are considered indicative.

It is apparent that autoclaving has a serious deteriorating effect upon gloves; daily chemical sterilization and daily boiling for a 15-day period produce little loss of tensile strength. The average strength of a "new" untreated glove for this series was 30 pounds (13.6 kilograms). During the 15-day period, daily chemical sterilization has a moderate advantage over daily boiling—25.8 pounds (11.7 kilograms) and 22.9 pounds (10.4 kilograms). Gloves treated continuously with the antiseptic solutions for 15 days retained an average tensile strength of 22.9 pounds (10.4 kilograms). This constant treatment is the equivalent of 2,160 "sterilizations" of 10 minutes each. Gloves subjected to constant boiling for this length of time were seriously deteriorated, retained a breaking strength of only 2.7 pounds (1.2 kilograms). It is seen that the destructive effect of heat sterilization upon gloves of high grade rubber is greatest after autoclaving; that the boiled glove shows little damage for 2 weeks; that destruction develops rapidly after an initial period of comparative resistance. While the tests indicate that the chemically sterilized glove has a 900-percent advantage (25.8 pounds versus 2.7 pounds) over the boiled glove (and greater still over the autoclaved) the actual figure, influenced by age and wear, is, of course, not so great.

TESTS OF STERILITY OF CHEMICALLY TREATED GLOVES

Gloves were chemically sterilized in 10 variants of the soap and water and germicide method. The finger tip of each glove was then applied to an agar plate. Plate readings were made at 24 and 48 hours. In table 2, the cultures reported are the total for 48 hours. Autoclaved gloves were used as a general control in this group (15 pounds for 15 minutes). Mercuric chloride solution was used as the test antiseptic in most of the investigations, followed by alcohol. Mercuric chloride was selected for its relatively noncorroding effect upon gloves, its effectiveness as a spore destroyer ("a 1:1000 solution will kill the most resistant sporulating organisms") (6), and because of its availability.

The first experiments emphasized the time of soap and water application, with chemical sterilization limited to short periods. Nonsterile gloves were washed on the hands for 5 minutes, then the hands and gloves placed in mercuric chloride 1:1000 solution for 1 minute, and in alcohol 70-percent solution for 1 minute. These gloves were all sterile after this preparation (80 fields). Gloves were then contam-

inated with moist pus (abscess), similarly treated, and again found sterile (100 fields). These experiments demonstrate the soundness of the Demmer method of glove preparation. Lt was established that a shorter period of chemical sterilization (2 minutes instead of 5 minutes) sufficed if gloves were washed on the hands for 5 minutes.

DEVELOPMENT OF A METHOD FOR NURSES' PREPARATION OF GLOVES

The disadvantages of the Demmer plan, enumerated above, prompted an investigation to establish a safe and practical method of nurses' preparation (pre-preparation) of gloves. One or more additional pair of gloves were accordingly washed with the applied gloves. To facilitate operating-room technic and shorten preparation time, the washing time was progressively reduced and the chemical exposure periods increased in duration. The results indicate that the two factors are complementary, in a measure interchangeable on an equivalent time basis. A pair of gloves washed on the hands for 10 minutes closely approaches a clinical sterility comparable to that of an unwashed pair exposed to mercuric chloride 1:1000 for a like period. Analogy to the preparation for operation of hands and arms is quite apparent. Table 2 summarizes these experiments. The "index" of nonsterility is

TABLE 2.—*Tests for sterility after chemical sterilizations*

Series	Preparation	Contaminated or unsterile gloves to start	Index of nonsterility	Number of agar plate fields
1	Autoclave 15 lb., 15 minutes	Unsterile	0.10	30
2	Wash 5 min., mercuric chloride 1 min., alcohol 1 min.	____do____	0	80
3	____do____	Contaminated (pus 80, fecal 20).	0	100
4	Wash 2½ min., mercuric chloride 2 min., alcohol 2 min.	Unsterile (not immersed)	.750	20
5	____do____	Contaminated (fecal) (not immersed).	.210	100
6	____do____	Contaminated (pus 80, fecal 80).	.025	160
7	Wash 2½ min., mercuric chloride 3 min., alcohol 3 min.	Contaminated (pus)	0	80
8	Wash 1½ min., mercuric chloride 3 min., alcohol 3 min.	____do____	0	40
9	Wash 1½ min., mercuric chloride 2 min., alcohol 2 min.	____do____	.050	80
10	Wash 1½ min., borax-formalin 2 min., alcohol 2 min.	____do____	0	30
11	Wash 1½ min., borax-formalin 3 min., alcohol 3 min.	____do____	.038	80
12	Wash 1 min., mercuric chloride 10 min., alcohol 1 min.	Contaminated (throat 40, pus 80).	0	120

an arbitrary figure, indicating the number of colonies per finger test field on the agar plates. It is seen that the only series in which this index was clinically unacceptable were those of the autoclaved gloves, and those of the chemically treated which were allowed to "float" in the antiseptic solutions (series 2 and series 4, not immersed). With washing time per pair of gloves reduced to 1½ minutes and total im-

mersion of 4 minutes, clinical sterility was achieved. A degree of sterility approaching maximum for experiments of this type was secured when total immersion time was prolonged to 6 minutes. From the practical viewpoint, the best method of chemical preparation requires the shortest personal participation time. In series 12, each pair of gloves was washed in running water with soap for 1 minute, fully immersed in mercuric chloride 1:1000 for 10 minutes, then fully immersed in alcohol for 1 minute. These gloves were sterile in all tests (120 fields), despite preliminary contamination.

The technic described has been selected as the most suitable for general use. The nurse preparing gloves by this method should scrub hands and arms for 5 minutes and wash hands and arms in alcohol for 2 minutes. She draws on a pair of gloves to be washed, and washes one or two additional pairs simultaneously, using 1 minute per pair (3 minutes for 3 pairs, or each pair may be washed separately for 1 minute). The gloves must be fully and constantly immersed in the antiseptic solution with all air removed; glass or porcelain paper weights may be used for this purpose. They are removed from the alcohol with sterile tongs and placed according to size in sterile towels or containers. The surgeon scrubs and disinfects hands and arms, using a 5-minute scrub and 2 minutes in alcohol or 1 minute each in mercuric chloride and alcohol. Gloves are put on by the surgeon while wet or dry; if dry, alcohol applied to the hands will afford easy adjustment of the glove. After operation, each pair of gloves is washed for 1 minute. In grossly infected cases they are soaked in mercuric chloride for 10 minutes, dried, lightly powdered and put away in clean (not sterile) towels or containers, according to size. It is the responsibility of the operating room supervisor to attend the proper fitting of gloves, and to secure and maintain gloves of correct size for operating surgeons and nurses. Sizes 6½, 7, 7½ and 8 should always be available.

DESTRUCTION OF SPORE-FORMING BACTERIA

As a glove conservation measure, the above plan (No. 12) is recommended for general hospital use. After operating on tetanus, anthrax or gas bacillus infections, gloves may be either boiled once for 50 minutes or boiled fractionally, at 24-hour intervals for 20 minutes (3 times). Or they may be immersed in mercuric chloride 1:1000 solution for 18 hours, or for 3 fractional periods (at 24-hour intervals) of 1 hour each. All of these methods provide a margin of safety.

(In many areas of the tropics, tetanus organisms circulate freely in the atmospheric air; during the dry season and sand and dust storms precautions should be taken. To this end, containers in which gloves or other surgical materials are immersed should be covered with towels.)

SUMMARY

1. Chemical sterilization of gloves, as practiced in these experiments, may be expected to extend the life of gloves several hundred percent (900 percent in tests).

2. A simple, effective method of chemical sterilization is presented: it consists of 1 minute of washing, 10 minutes of exposure to mercuric chloride 1:1000 solution, and 1 minute's immersion in alcohol 70 percent. It provides complete sterility.

3. Modifications of this method are applied to the destruction of spore-bearing organisms.

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TREATMENT OF HYDROCELE [1]

By Lieutenant Commander V. E. Hockett, Medical Corps, United States Naval Reserve

In this day of rapid advances in the field of medicine and surgery, and the excitement of war, it may seem unjustifiable to speak of such a trivial disease as hydrocele. Selective Service statistics, in a series of 19,923 registrants examined, found 58, or 2.9 per thousand, to have a hydrocele of sufficient size to disqualify the registrants from general military service. Selective Service Physical Standards states that a registrant will be acceptable for general military service if the hydrocele is of moderate size. The above figures would, therefore, only class registrants who had a "hydrocele, if large and considered irremediable to a degree which would qualify for class I–A, but would permit limited service," (Selective Service Physical Standards). These figures include only males between the ages of 21 and 36 years.

The treatment advocated is not new or original as it is mentioned in many articles; yet, on questioning various medical men the usual

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answer is that they had not heard of the treatment, were afraid of getting a slough which, of course, would be rather embarrassing, or were using quinine and urethane solution which causes considerable pain, swelling and disability. Other medical men prefer to accept a somewhat higher fee and perform the uniform surgical procedure.

The simplicity of treatment justifies the reiteration and is the excuse for this article. The technic of treatment of hydrocele is as follows:

1. Surgical preparation of skin of scrotum.
2. Local anesthesia, if desired.
3. Introduction of a No. 19 needle into sac.
4. Withdrawal of all fluid in sac that is possible.
5. Through the same needle, without removing it, introduce 3 to 4 cc. of 5 percent sodium morrhuate directly into the sac.

Treatment following the injection:

There will be pain in 3 or 4 hours of varying intensity, and if severe enough give ¼ gr. morphine sulphate and 5 grains of aspirin by mouth. Repeat the aspirin if necessary. There will be, following the initial pain, pain of decreasing severity over a period of a day or so, and there will be some swelling. Advise patient to wear a suspensory.

Advise patient to return to office in 5 weeks, at which time it will be impossible to determine the site of the recent pathology.

SUMMARY

An effective, simple method of the treatment of hydrocele.

REFERENCES

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CHRONIC SEASICKNESS [1]

NEUROLOGICAL, PSYCHIATRIC, AND NAVAL ASPECTS

By Lieutenant Commander Robert S. Schwab, Medical Corps, United States Naval Reserve

INTRODUCTION

Seasickness is a condition familiar to most of us, taken lightly by nearly all except the immediate victim, and given little if any emphasis by doctors or textbooks as a disease entity. Yet, vomiting ashore commands immediate respect with gastro-intestinal series, ophthalmoscopic examination, or even psychoanalytical approaches.

The literature on this subject, in spite of the undeserved, quasi-humorous aspect attributed to it by most people, is surprisingly extensive. In the last 26 years, from 1915 through 1941, 129 articles on

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this subject have appeared. During times of stress and war, the interest in this subject is slight, only 9 papers being written from 1915 to 1925. In the prosperous period from 1925 to 1930, when people traveled extensively, over 69 articles appeared. Since the onset of the depression in 1929 there has been a falling off in the number of articles on this subject; and, in the year 1941, no articles appeared at all. Of 128 papers, which are listed in the appended references, many are highly theoretical and others are personal experiences and ideas on the subject with little accurate information. A few are well-written general discussions with emphasis on the history and the incidence of seasickness as encountered by ship surgeons of large liners.

<div align="center">LITERATURE</div>

Articles by Brooks (17) (18), Poppen (99), and Sargent (108), in the American literature; Flack (47) (48), Hill (56) (57), Keevil (63) (64), Maitland (77) (78) (79) (80), and Marrack (81), in the British literature; and Bohec (9) (10) (11) (12) (13) (14) (15), and Danielopolu (29), in the French literature represent the most interesting and valuable contributions on this subject. An excellent review of this extensive literature by McEachern (82) will appear very shortly in War Medicine.

In the vast bulk of material on seasickness, no convincing data exist which makes the etiology clear. There is a general feeling that individuals with instability of the vegetative nervous system, particularly of the hypersensitive parasympathetic types, are more susceptible to seasickness than others. It is generally accepted that although many of the symptoms seem to be labyrinthine, the labyrinth itself is not the cause. The wisest commentators agree that a combination of a sensitive vegetative nervous system in the presence of excessive labyrinthine, psychic, visual, olfactory, and dietary stimuli is responsible. There is a feeling in some of the English literature that susceptible individuals are usually tall, thin, constipated, nonathletic, southern Europeans (not British).

As to therapy, practically every drug in the pharmacopeia has been tried and recommended by someone. There is one naive, homeopathic suggestion that because a seasick man is tossed about on a salty ocean, the therapy should be salt water tossed about in his stomach; this produced disastrous results on the patients on whom it was tried. There is general agreement that atropine drugs and sedatives are most promising. The most interesting observations have been made by Danielopolu (29), who experimentally found small doses of atropine stimulated the parasympathetic and made his patients worse. Therefore, he recommends full atropinization of his subjects 2 or 3 days before they sail. He starts them off with $\frac{1}{150}$ of a grain of atropine sulfate four times

a day and increases the dosage as high as $\frac{1}{75}$ of a grain four times a day, and uses the pulse as an indication of overdosage, keeping it under 85. This medication is continued throughout the voyage or until good sea legs have developed. The dosage is then gradually reduced (sudden reduction would cause an overreaction). This has produced very impressive results in his patients. The use of benzedrine sulfate and barbiturate drugs has met with indifferent success. Every writer on the subject has his own special formula for prevention and treatment, and it is not the purpose of this paper to discuss or analyze these. In intractable cases it is agreed in the literature that the only treatment that promises universal success is to sit under a live oak tree.

GENERAL DISCUSSION

About 40 percent of any population group (including the English by their own admission) are susceptible to seasickness on sudden exposure to rough weather at sea. These figures represent an average of my own observations and the material in the literature. About 5 percent of such a group are subject to intractable seasickness. One would naturally expect by the laws of personal selection that the incidence of intractable seasickness would be very much lower in marine or naval populations. Rough estimates are that between one-fourth and one-half percent of seagoing people are afflicted with chronic seasickness. In peacetime the figure is kept low because such persons tend to leave the service or get shore billets or manage to survive undetected because the vessels are in port so much of the time. In war, however, the incidence of chronic seasickness rises sharply because such individuals are recalled to active duty, shore jobs are hard to get, and the fleet keeps to sea in all weather most of the time. Furthermore, during war, vessels are less well-ventilated and are driven harder into heavy seas than during peacetime. An additional fact to account for an increase in chronic seasickness during war is the great increase in small vessels used for patrol and convoy work in all sorts of weather.

This investigation, which is only a preliminary report, was undertaken to see if there were any characteristics or findings in these chronic seasick sufferers to account for their need for hospitalization. Since December 20, 1941, 38 such cases in naval personnel have been carefully studied as to history, neurological, and psychiatric findings, and a certain amount of laboratory work done. About 25 other individuals in the naval service, who had been seasick, but recovered in 2 or 3 days, were interviewed as a control group. A questionnaire was used which included remarks on race, background, body type, previous sea experience, and a detailed history of nausea and vomiting previous to the seasick episodes. It was seen early in the study that there were 2 main

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groups of individuals which were sharply differentiated by the pres-
ence or absence of previous sickness from other forms of motion, such
as in a car. For the sake of classification the 38 patients examined were
divided into these 2 groups which are called type 1 and type 2.

TYPES OF SEASICKNESS

Type 1.—Defined as constitutionally subject to seasickness. In
these individuals there is a strong and uniform history of nausea or
vomiting in the patient when riding in cars, trains, busses, and trol-
leys, or when on swings, roller coasters, merry-go-rounds, whips, and
sudden violent motions; or in elevators and seesaws. There is often
in this group a history of nausea or vomiting from bad smells or tastes
ashore, the sight of blood or other unpleasant visual situations, such as
an automobile accident; and during pain or intense emotion or anxiety.

Type 2.—This is a severe seasickness but not nearly so bad as type 1;
in most cases with no history of sickness from the movements men-
tioned in type 1, and with no nausea or vomiting from the emotional
situations described there. In type 2 there are two mild forms not
associated with nausea and vomiting:

Type 2A.—Found in winter on small vessels. There is distaste
for tobacco in all forms, and a moderate anorexia for food. There is
a disinclination to be sociable and a strong tendency towards fatigue
and irritability, and some sleeplessness with mild disturbing dreams.
There may be disturbances in heat regulating mechanisms so it is diffi-
cult to get comfortable, either one is too hot or too cold. There is a
possibility that this symptom complex may be aggravated by insuffi-
cient vitamin B_1, insufficient sodium chloride, or tension and fatigue.
This group has not been hospitalized and the study of it is very
incomplete.

Type 2B.—Postural form. There is difficulty holding the head up,
some vertigo, mild blurring of vision on reading fine print, and some
unsteadiness of gait. Absolutely no gastro-intestinal symptoms.
There is complete relief with lying down, in spite of the severest
weather. The condition is chronic, but disappears immediately with
calm weather.

Type 2C.—Vestibular form. Vertigo is extreme. There is some
photophobia, unsteadiness of gait, considerable nausea, and very little
vomiting. Lying down more or less neutralizes this type.

Type 2D.—Vomiting type. This is the most common. Nausea and
vomiting tie closely together. There is also retching, salivation, ex-
treme vomiting, sweating, and even diarrhea. There is little vestib-
ular involvement here, and, in between the gastro-intestinal upheavals,
the subject is able to be up and about in spite of rough weather. Weight
loss and the resulting acidosis and dehydration produces some weak-

ness, which is the complicating factor and interferes with their work.

Type 3.—There is a third type of seasickness which is similar to type 1 and type 2, but is complicated by the presence of organic disease such as an active duodenal ulcer, cardiac condition, or some strong preexisting neurotic situation.[1]

Type 4.—The fourth type of seasickness is found in subjects who are seasick for only 2 or 3 days and then recover. This group was not encountered in this investigation.

METHOD OF STUDY

All patients were given a careful neurological and psychiatric examination. Gastro-intestinal series, and vestibular tests as well, were done on as many as possible. In a few cases rough estimates of the patient's efficiency during his seasickness were obtained from officers on the vessel, and in most of the others, subjective reports were also obtained. There was general agreement that in the type 1 cases, efficiency was lower than 40 percent on the largest of the vessels and dropped down to 0 in the smaller vessels in rough weather. In type 2, on the other hand, efficiency on large vessels was as high as 90 percent in most cases, even in rough weather, and dropped off gradually as the vessel became smaller and more likely to be tossed around under the same conditions. Even on patrol craft in the Atlantic in winter, these people (type 2) do about 40 percent of their work, whereas in the type 1 group their efficiency would be 0.

The gastro-intestinal series revealed a surprisingly high percentage of abnormalities. In the total group examined by this method, 11, or 50 percent had abnormal barium studies. This consisted of either marked pyloric or duodenal spasm or prominent and pathological hypertrophy of the gastric rugae with some hypersecretion.[2] In 2 cases,

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[1] An excellent example of such a case is the personal story of a nationally known surgeon who was good enough to recount the following: "From the age of 20 to 35 I was always seasick on vessels of all types. In any weather except the calmest, I was forced to my bunk where continuous vomiting made me a useless and objectionable passenger. There did not seem to be any tolerance developing. Although I loved the water and sea trips, I was miserable most of the time. Typical ulcer symptoms finally showed up ashore. An operation involving the removal of a piece of stomach with its obstructing pyloric ulcer and the introduction of a wide posterior gastro-enterostomy was performed when I was 35. For the last 20 years I have hardly been seasick and can enjoy meals cooked in the stuffy galley of a small boat in all sorts of weather."

[2] Dr. Chester Jones of the Massachusetts General Hospital, Boston, who read this manuscript, points out that barium studies alone are not proof of true hypertrophy of the gastric rugae or the presence of a frank gastritis. Gastroscopy, which would confirm these findings, was not available in this series, but is being considered if additional material is to be studied.

Since the original manuscript was prepared, one patient with hypertrophic gastritis, by barium studies, was gastroscoped by Dr. Edwin Benedict of the Massachusetts General Hospital who confirmed these findings. Another patient with a negative G. I. examination, was gastroscoped on the same day, which also confirmed the negative findings.

both were encountered. Both groups seemed to be liable to abnormal gastro-intestinal findings. As to the psychiatric findings, the incidence of neurotic traits and neurosis was much higher in type 1 than in type 2. This is well shown in table 1. Two-thirds of 15 cases in type 1 showed neurotic traits or were frankly neurotic individuals, whereas only 26 percent were encountered in the 23 of type 2 cases

TABLE 1.—*Contrasting the 2 types of seasickness*

	Type 1	Type 2
Number of cases	15	23.
History of car, train, swing sickness, etc.	Yes	No.
Able to work	No	Yes.
Efficiency at sea	0 to 10 percent	40 to 60 percent.
Loss of weight	Marked	Slight.
Prognosis	Poor	Good.
Disposal suggested	Survey or shore duty	Larger ship or preventive treatment.
ANALYSIS OF DATA		
Psychoneurotic	4 ⎫ 66 percent	1 ⎰
Neurotic traits	6 ⎭	5 ⎱ 23 percent.
Abnormal G. I. series	6	5.
Normal G. I. series	4	7.
History of head injury	3	5.
Subject to fainting or vertigo attacks	8, 53 percent	4, 17 percent.

studied. About one-fifth of the total number of cases gave a history of head injury with unconsciousness some time in the past. This is probably close to the incidence of this finding in normal population of seafaring individuals. It is probably of no significance. There was a strong history of fainting or vertigo attacks in type 1 (53 percent), whereas this was not common in type 2 (18 percent). None of the cases tested with vestibular examination showed any abnormalities, either hypo- or hyper-excitable labyrinth. There was no history of ear trouble in any of the subjects. The type 1 individuals usually had a marked loss of weight during their sea experience (20 to 30 pounds) and they suffered exceedingly from dehydration and acidosis, whereas this was very slight in the type 2 individuals. There was no relationship to race, family background, home terrain or body type, in either of these groups. Neurological examinations were universally negative. Electroencephalograms were negative.

It is to be mentioned again that the type 1 individuals were unable to work at sea, even in calm weather, and, therefore, had a low efficiency on ships in general, whereas the type 2 men were usually able to do their work and even in rough weather maintain 40 to 60 percent efficiency for their sea work. With this in mind, one would suppose that it would be wiser to discharge or send to shore duty those individuals in type 1 whose value at sea is so small. The type 2 group could be handled by either moving them to a larger vessel or concentrating on some prophylactic or therapeutic procedure which would

increase their efficiency and take care of their problem. One would also assume that the type 2 individuals in some way or other would eventually overcome their problem, unlike type 1. A summary of these findings is shown in table 1.

CASE REPORTS

Type 1.—A doctor with an excellent and stable past history including medical school and internship work, whose naval career ashore was without incident, was assigned to a destroyer in the winter months on the Atlantic. It was his first ocean experience. He gave a strong history of car, train, roller coaster, swing, etc., sickness. Otherwise, the patient's history was irrelevant. He felt uncomfortable as the ship left the wharf. Perspiration and uneasiness followed. With the first roll inside the harbor there was immediate nausea and vomiting. He took to his bunk. Vomiting and nausea continued for 3 weeks with a weight loss of 25 pounds. There was a gradual onset of a mild mental depression because of the realization that he was useless at sea. Because of this, he was transferred to a larger vessel, and strongly urged to leave his bed and sit in the ward room; he found no improvement. Seated in a chair, with waves of nausea coming over him, he was interviewed by a medical officer, but he was afraid to open his mouth for fear of vomiting on the attending doctor's clothes, and between his teeth he muttered answers to the questions. He expressed no concern over the possibility of his being washed overboard during his vomiting and admitted his depression and discouragement. So severe was this man's reaction to his seasickness that a diagnosis of psychosis was made and he was sent to a naval hospital.

His recovery was miraculous, in hours, and no evidence of a mental disturbance was found. Except for the weight loss, physical examination on entry was within normal limits. The gastro-intestinal series showed marked pyloric and duodenal spasm with some hypersecretion. Even after 9 weeks on various sized ships, he failed to show any trace of developing a tolerance or of overcoming his difficulty. He is constitutionally unfit for sea duty and can only be useful ashore.

Type 2.—Seaman, first class, with a 3-year history of excellent record on a battleship, cruiser, and navy transport. Occasionally he is seasick the first day or so on these vessels, but recovers quickly. There is no history of car sickness, train sickness, etc. When transferred to a destroyer in winter, his seasickness persisted for over 5 weeks. He was able to do his work and stand his watches, although with reduced efficiency. Finally, since his vomitus was blood-tinged, the medical officer sent him ashore for hospital study. There were no mental symptoms. Weight loss was 7 pounds. Physical and neurological examinations were negative. Gastro-intestinal studies were negative. This man will probably overcome his difficulty even on a destroyer after a lapse of time, or with therapeutic regulation. He would do perfectly well transferred back to a larger vessel. He is still useful at sea in spite of his seasickness.

DISCUSSION

Two cases studied in this group showed a frank psychoneurosis which was built around their inability to get along at sea. They were unstable individuals and readily showed evidence of a neurotic character. Although their seasickness might conceivably be arrested, the

presence of a neurosis renders them unfit for sea duty. It must be kept in mind that seasickness may be disguised as gastroneurosis, hypochondriasis, migraine, or temporary bouts of inaptitude. It is further to be remarked that in any protracted seasickness, certain perfectly reasonable psychiatric symptoms will develop, such as depression, fear, etc. Furthermore, in susceptible individuals subject to a long and severe exposure to seasickness (several weeks), the memory of this is so devastating that nausea and vomiting might ensue ashore on their being ordered back to the same vessel. This actually happened in the case of an officer who had type 1 seasickness to a very severe degree and had been at sea for 7 weeks—most of which time he spent in misery in his bunk. When he was fully restored as to weight and morale, after 4 weeks in the hospital, he was ordered by the Bureau of Navigation to report once more to his ship. On being told this he became sick and vomited in the office of the hospital (ashore). Frequently, dogs, made sick on mechanical agitators, will vomit if placed on the machine when it is at rest. This type of conditioned reflex is to be expected from the experiments of Pavlov (95). A number of type 1 cases complained of harrowing nightmares and almost morbid fear of ever going back to the same ship. It is something analogous to a person who has just come through a severe lobar pneumonia, and who has been told he would have to go through it again.

Since type 1 of the chronic seasick group is so sharply differentiated from the other types by the strong history of sickness from other sorts of motion, it would be a simple matter to spot most of these, if not all, by means of a simple questionnaire which covers the history of nausea and vomiting from motion in cars, trains, swings, roller coasters, busses, etc. and associated with emotional disturbances. If officers or others were questioned before undergoing long periods of expensive training ashore, it would seem reasonable that the number of such individuals in the Navy in this group could be effectively reduced.

SUMMARY

A brief survey of the literature on seasickness is described. Thirty-eight cases of chronic seasickness in naval personnel are described and they fall into two groups:

Type 1. Constitutionally sick, with history of car, bus, and other sickness. Efficiency at sea extremely low.

Type 2. Severe seasickness, without the history of other sicknesses ashore, with a fair degree of efficiency at sea.

It is suggested that type 1 cases are not useful afloat and might be either discharged from the Navy or placed on shore duty. It is felt that type 2 will improve with time and treatment, or with transfer to a larger ship. Gastro-intestinal abnormalities were found in over half

of the whole group. The type 1 case has a high incidence of neurotic traits and tendency towards fainting. Both of these are low in type 2 patients.

There is no correlation with background, race, body type, in either of these forms of seasickness.

A simple questionnaire will spot the type 1 individuals. Further study of this problem is contemplated, particularly the collection and correlation of more clinical data.

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A COMPARISON OF CERTAIN DRUGS USED AS LOCAL APPLICATIONS TO BURNS [1]

By Commander T. McKean Downs, Medical Corps, United States Naval Reserve

A recent opportunity to see a considerable number of burn cases (about 35) has allowed me to reach certain definite conclusions as to the relative desirability of some of the drugs which are commonly applied to burned areas. The patients under my care suffered mostly from burns caused by the flash of bursting high explosives contained in aerial bombs or shells. The injuries were often extensive, but not deep; none of them were classified as third degree. Many of these patients received first-aid treatment before reaching my care; others were admitted directly, before any treatment had been instituted.

The first-aid treatment employed had been either a tannic acid spray, or the application of tannic acid jelly. Definitive treatment was directed to combating shock. After the patients had improved, the wounds were cleaned, dead skin cut away, blisters opened and debrided, and all tannic acid jelly removed. Gentian violet 2 percent solution was then thoroughly painted on, and the wound was left uncovered and exposed freely to the air. A few patients who had been thoroughly tanned with tannic acid were left alone.

All of our patients did well. No infections developed, healing was prompt, and the last one was discharged to duty about 4 weeks after the injury was received.

In civil life, I had, for some time been of the opinion that the choice between tannic acid and gentian violet solutions as an application to a burned surface was a matter of indifference. The use of gentian violet on this group of patients was partly to test this belief. The experience thus gained has forced me to the conclusion that the dye is definitely superior to tannic acid.

The eschar produced by tannic acid is thick, hard, and contracts very markedly—so much so that when it encircles an extremity, it often seriously impairs circulation. Gentian violet forms an eschar that is thinner, softer, and much less subject to contraction. It is more analgesic than tannic acid, and stops the pain of the burn almost at once. It is antiseptic, and I feel this is partly the reason for the complete absence of infection in my patients. It seems to encourage epithelization; at least the crust came off in all cases, leaving a healed surface, sooner than had been anticipated. Last, and perhaps most important, gentian violet is relatively harmless to the tissues.

I have long noticed, as doubtless others have also, that burns treated with tannic acid solution prove to be deeper than was at first apparent. Injuries, originally classified as second degree, often heal with scarring and other evidence of destruction of tissue. This has been attributed to the nature of a burn, which is assumed to injure tissue so severely that it later dies, though at first sight appearing viable. Recently, doubts have arisen in my mind as to the correctness of this assumption. I have wondered whether this delayed tissue destruction may not have been due to the treatment employed, rather than to the heat itself. From observations on this group of patients, and particularly on two of them, I feel sure that tannic acid solution causes tissue destruction beyond that caused by the burn.

The injuries sustained by the two patients were quite similar in character. Both were wounded, in the same engagement, by the flash of bursting high-explosive projectiles. Both had extensive second degree burns of the thighs and legs, coupled with other minor injuries. One man, who was slightly less extensively injured, had been thoroughly sprayed with tannic acid solution at a first-aid station, and firm eschars had already been formed on his admission to the hospital. The other had received no previous treatment. He was treated for shock, his wounds cleaned, and gentian violet solution applied.

To my surprise, the second case, who was the more seriously injured of the two, made an earlier recovery. His eschars came off, leaving smooth, well-healed surfaces underneath. The first case required about a week longer before the crusts loosened, and on removal there was found a granulating surface that required another week for complete epithelization to occur.

The only real objection to gentian violet solution is that it stains all fabrics an indelible blue when in contact. This fault can be avoided

by protecting all bed linen with a rubber sheet; or certain bedding can be set aside for the use of burn patients, and allowed to remain stained. The color is unsightly, but causes no injury to the cloth.

In this paper, I do not consider the important subjects of shock, or of the constitutional reaction to extensive burns, which are factors not to be forgotten in the treatment; nor have I any experience with the sulfadiazine spray, which is still in the experimental stage and not available for general use.

CONCLUSION

The eschar produced on a burned area by gentian violet 2 percent solution is superior to that resulting from tannic acid, in that it is more analgesic, softer, and has very slight tendency to contract. The gentian violet causes little, if any, tissue destruction, but, on the contrary, stimulates epithelization.

An objection to the dye is that it permanently stains all fabrics with which it comes in contact.

AUDITORY ACUITY AMONG SUBMARINE PERSONNEL [1]

By Lieutenant Commander Charles W. Shilling, Medical Corps, United States Navy, and Pharmacist Ira A. Everley, United States Navy

Part IV [2][3][4]

HEARING LOSS DUE TO EXPOSURE TO GUNFIRE

This is the fourth in a series of articles on auditory acuity and presents permanent loss of hearing due to exposure to heavy gunfire. The physical examinations and the technical operations were conducted and the histories recorded as detailed in the first article of this series (1).

The men for this section were selected on the basis of a positive answer to the question, "Have you suffered loss of hearing and/or ringing in your ears lasting for over half an hour as a result of exposure to gunfire?" Almost every man in the United States Naval Service has, at one time or another, been at least temporarily deafened by exposure to gunfire; thus particular effort was made to elicit a true history on this point, so as to be certain there was significant loss of hearing or tinnitus definitely associated with gunfire. If the answer was in the affirmative, a detailed history was taken concerning type of guns, length of exposure, wearing of cotton and any other pertinent facts. In this group we have included a man who had been in the im-

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mediate vicinity of an engine crank case explosion, and one who had been exposed to dynamiting. These cases were included in this category because the etiology and character of the resulting loss of hearing closely resembles that found in the gunfire cases.

The "pure" cases in this article are, as before, only those who gave no history of any disease or condition considered conducive to loss of hearing, other than exposure to gunfire as defined above. The "miscellaneous" gunfire cases were those whose history indicated that in addition to gunfire, they had suffered from infections, diseases, or acoustical trauma other than gunfire, which, in themselves, were predisposing to deafness.

Opportunity for examining men experiencing acute loss of auditory acuity due to exposure to gunfire did not present itself; but acute loss has been of such frequent incidence in both civil and military life that its occurrence cannot be questioned. Many of our subjects gave definite histories to this effect. For example, one man said, following exposure to 5-inch 51-caliber firing, "I just couldn't hear at all." Again, an officer reported that following discharge of a 45-caliber automatic pistol immediately beside his right ear, he was totally deaf in that ear for "many hours" and this deafness was associated with pain and tinnitus. Another man reported that he was "deaf in the right ear for a few days and had ringing and a dull ache for a week" following gunfire exposure. Another lost the cotton from his left ear on the first shot of a 4-inch 50-caliber gun with the result that after "cease firing" he had a complete rupture of his left drum with hemorrhage lasting for half an hour and complete deafness lasting for a day. The hearing gradually improved. This type of history was encountered so often that even though unsubstantiated by audiometry, there can be no doubt that gunfire causes loss of auditory acuity in many cases. A case showing marked acute loss due to exposure to a fire-cracker explosion, with subsequent recovery, was presented by Bunch (2). He also presents a number of cases of acute and permanent loss of auditory acuity associated with exposure to small arms firing (3).

Permanent loss of auditory acuity among men exposed to heavy gunfire is presented in table 1. In this table we present our "pure" cases whose mean age is 30.36 years, and, for comparison, give our

TABLE 1

Frequency	64	128	256	512	1024	2048	4096	8192
Normal, ages 25–34	+0.7	−1.3	+3.8	+5.8	−0.5	+5.9	+10.5	+15.0
Gunfire "pure," average age 30.36	+3.04	+1.83	+5.71	+9.92	+4.18	+19.02	+33.40	+35.04
Public Health 35–44	+3.2	+3.8	+8.6	+8.0	+3.0	+4.2	+26.2	+21.7
Gunfire "miscellaneous," average age 35.80	+11.18	+10.45	+17.12	+18.99	+11.85	+28.60	+49.46	+42.07
Gunfire "Ridout," ages 30–39	+4.8	+9.0	+15.4	+21.3	+26.4	+29.7	+40.3	+31.9

normal group for ages 25 to 34 years. The loss for the four higher frequencies averages 15 decibels more than that of the normal group of the same age and for the two highest, i. e. 4096 and 8192, the average is 21.5 decibels greater. Neither group gave a positive history of any disease, injury or condition which might adversely affect the hearing, except that the "pure" group answered the gunfire question in the affirmative. The "miscellaneous" group, mean age 35.80 years, also presented in this table, shows a loss much greater than the "pure" group, which is to be expected because of the multiplicity of etiological factors. For comparison with this group we have presented the United States Public Health (4) normal for ages 35 to 44 years. Our "miscellaneous" group shows a total average loss 13.5 decibels greater than that of the Public Health normal even though the Public Health average age is considerably greater. The loss at 2048 is 22.6 decibels greater. In as much as the Public Health normal is on a relatively unselected group, as explained in Part I of this series, this extreme loss in our "miscellaneous" group assumes added significance. Also presented in this table (table 1) are the records for officers, ages 30
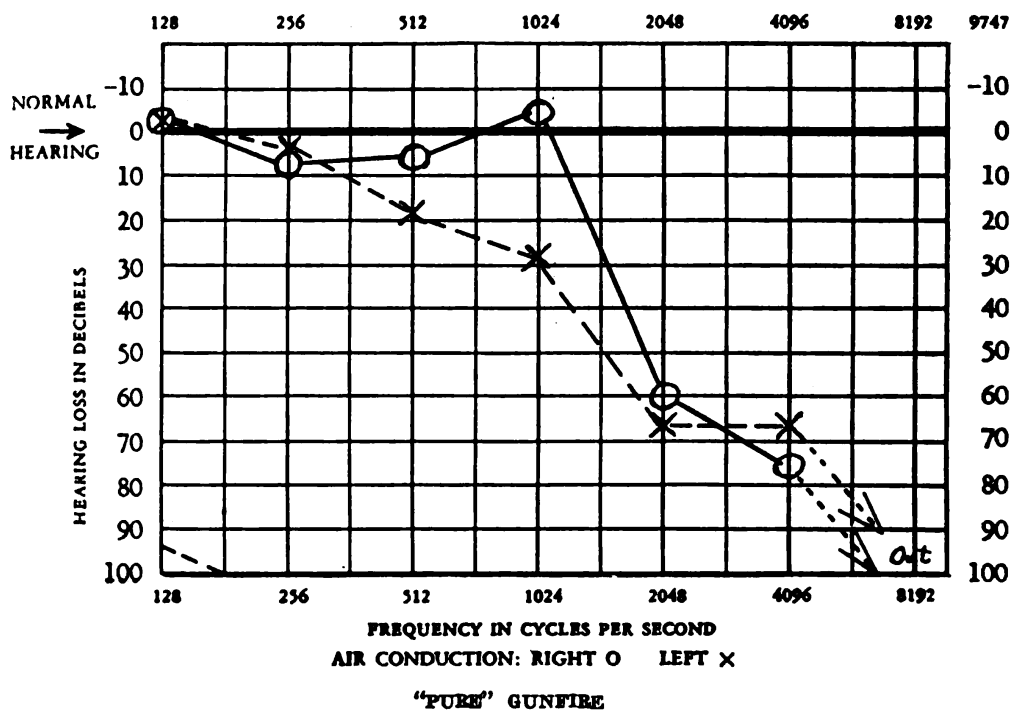
FIGURE 1.—G. E. B., C. B. M. Age 48 years. Naval service 16 years. No submarine duty. Was out of the service for 11 years, then recalled to active duty. Was exposed to heavy gunfire many times. On his first cruise noted some loss of hearing. He is convinced his loss of hearing is due to traumatism by gunfire. History otherwise negative. Both drums slightly retracted. Watch tick: right and left, contact only. Whispered voice: right 3/15, left 2/15. Coin click: 0/20 both ears. Physical examination otherwise negative.

to 39, exposed to gunfire, as reported by Ridout (5). Individual cases presenting the effect of gunfire trauma as evidenced by loss of auditory acuity are given in figures 1 to 8; figures 1 to 4 being "pure" cases and figures 5 to 8 "miscellaneous" cases. An additional case presented as figure 9 in this series illustrates the rather rare condition of hyperesthesia acoustica. Even a moderately loud sound is distressing and causes a feeling of actual pain in his ears. The condition was either precipitated by or first noticed following gunfire trauma, and for this reason the case is included in the gunfire section. This case resembles shellshock and his reactions are definitely neurotic, but the loss of auditory acuity is an actual loss and must be considered due to traumatism by gunfire. A detailed description accompanies each of these representative cases.

DISCUSSION

Deafness due to gunfire trauma is well known to military men and is expected to occur in the majority of cases in which the trauma is severe. Such deafness is of the perception or labyrinthine type.
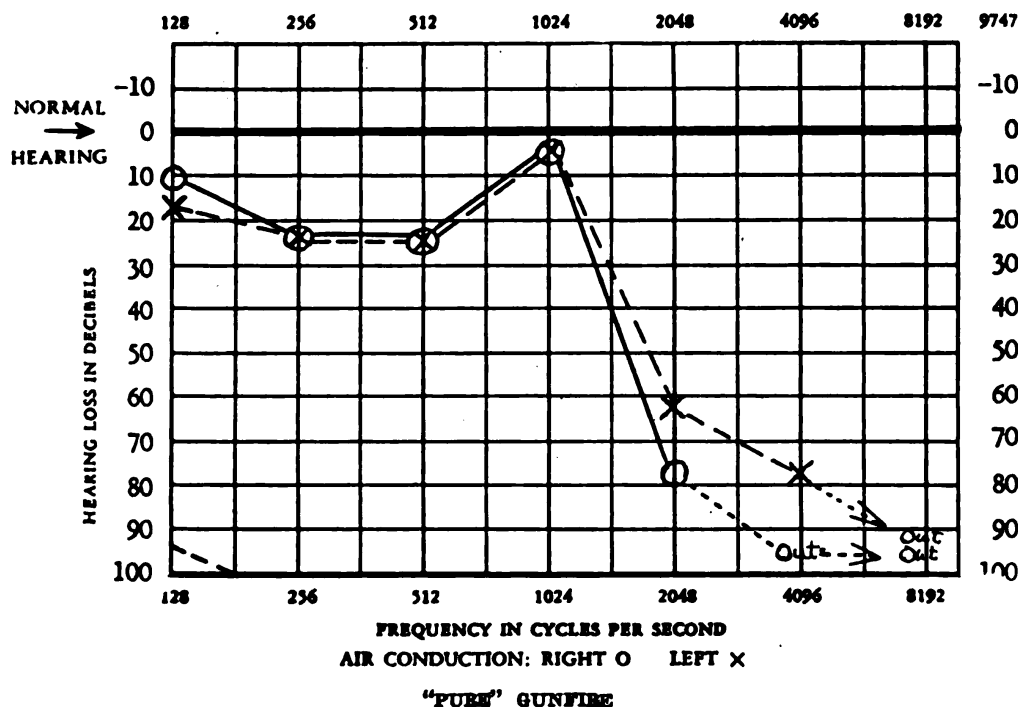
FIGURE 2.—C. H., Lt., U. S. C. G. Age 33 years. Naval service 8 years. Totally deaf for 2 days following exposure to 5″ 51-caliber gunfire. "Just couldn't hear." History otherwise negative. Both drums dull and thickened. Watch tick: right ½/40, left contact only. Whispered voice: right 3/15, left 1/15. Spoken voice: right 15/15, left 10/15. Coin click: right 10/20, left 5/20. Rinne positive. Physical examination otherwise negative.

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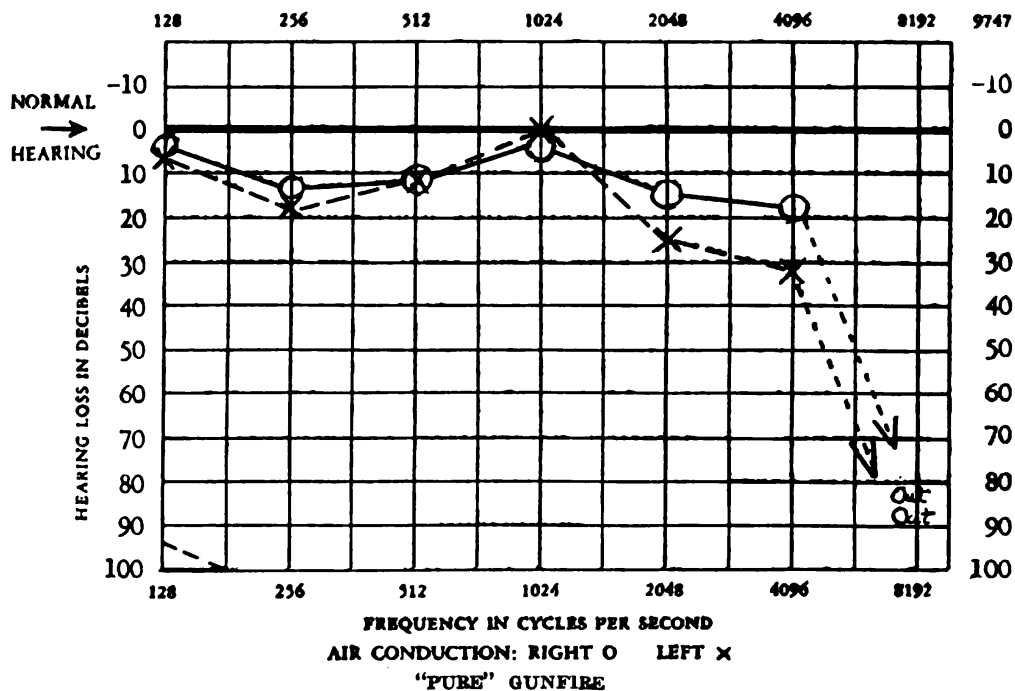
FIGURE 3.—P. L. K., C. G. M. Age 38 years. 20 years' naval service. Periodic firing of submarine 3" guns for 15 years, wearing cotton in his ears. Says "It hasn't affected my hearing." History otherwise negative. Ear drums normal in appearance. Watch tick: left 30/40. Physical examination otherwise negative.
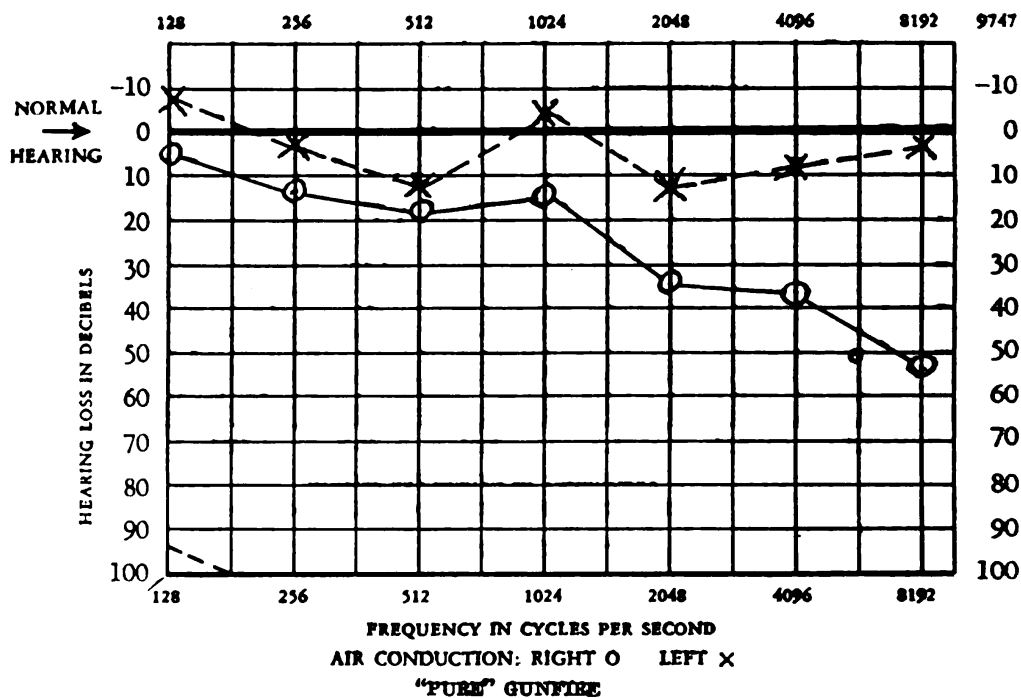
FIGURE 4.—R. S. T., Cox. Age 21 years. 3 years' naval service. One year prior to this examination was near a 5" 25-caliber antiaircraft gun on "commence firing." Right ear deafened for a few days, ringing and dull ache for a week. No difficulty with left ear. History otherwise negative. Ear drums appear normal. Watch tick: right 12/40. Whispered voice: right 6/15. Physical examination otherwise negative.

Got (6) describes loss of hearing due to gunfire as follows:

The deafness is always of the labyrinthine type * * * there is abolition of cranial perception to the watch, abolition or considerable diminution of aerial perception, diminution of acuity more marked for high than for low tones, for whisper than for spoken voice. Rinne positive or barely negative; lateralization of the Weber test to the sound or the less affected side * * * if the deafness increases, it is on account of some intercurrent cause arising.

Nimier (7) in 1889, stated that much of the hearing loss caused by these explosions was due not to the trauma in the middle ear but to the effects on the nervous structures within the cochlea. It will be noted that our experiments confirm this fact. The loss in our cases is particularly marked in the higher frequencies, and is of the perception type. Others have reported losses predominantly in the fourth and fifth octaves, but, as seen in our figures, although we have noted some loss in

FREQUENCY IN. CYCLES PER SECOND
AIR CONDUCTION: RIGHT O   LEFT X

"MISCELLANEOUS" GUNFIRE
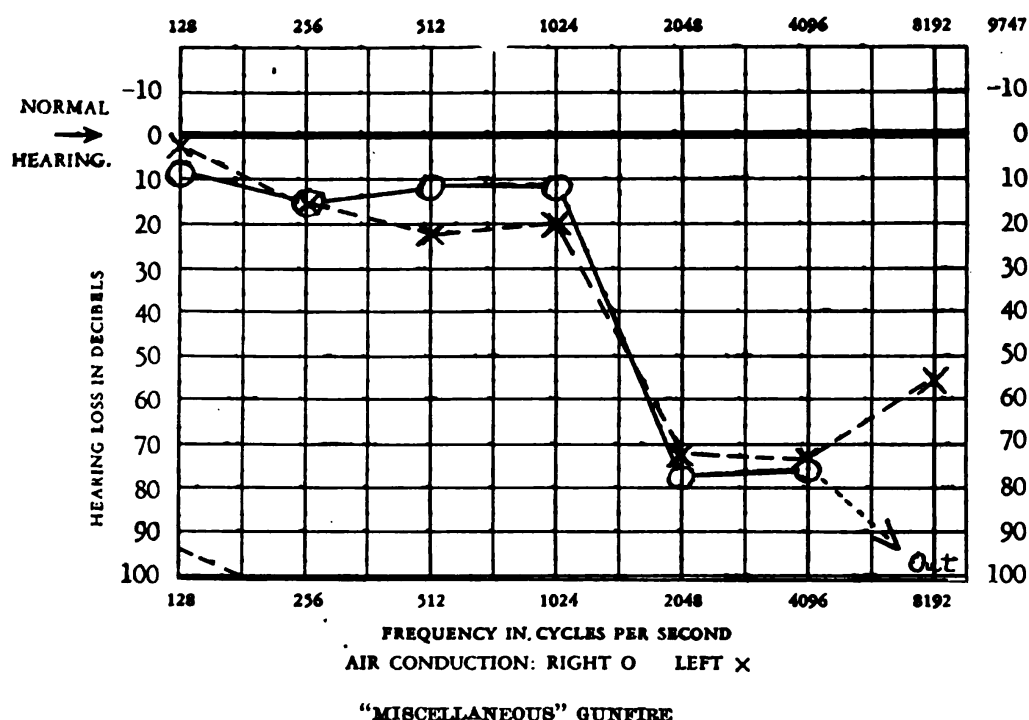
FIGURE 5.—C. E. O., C. M. M. Age 49 years. Naval service 18 years. During World War at age of 29 years was exposed for 1 year to firing of 155 mm. howitzers. Ears seemed continuously "stopped up". Was in U. S. Army Artillery 4 years. At age of 27 years had tinnitus for a week following Fourth of July celebration. Scarlet fever at age of 9 years. Syphilis at age 37 years, well treated. Father slightly deaf all of adult life. History otherwise negative. Physical examination: Ear drums slightly thickened. Watch tick: contact only. Whispered voice: 0/15 both ears. Spoken voice: right 15/15, left 13/15. Coin click: right 3/20, left 5/20. Physical examination otherwise negative.

these frequencies, the more consistent and greater losses are in the seventh octave which includes the frequency 4096.

As a group, these cases also show a rather marked diminution of auditory acuity when tested by spoken voice, whispered voice, coin click, and watch tick. Tuning fork examinations demonstrated that air conduction was greater than bone conduction (positive Rinne). As a rule, the Weber test was negative.

PREVENTION

The cases presented are representative of many giving similar histories. Obviously, the prevention of this traumatism is of great importance and, since the use of cotton plugs, if properly applied, and if not removed until after all firing has been completed, has been

"MISCELLANEOUS" GUNFIRE
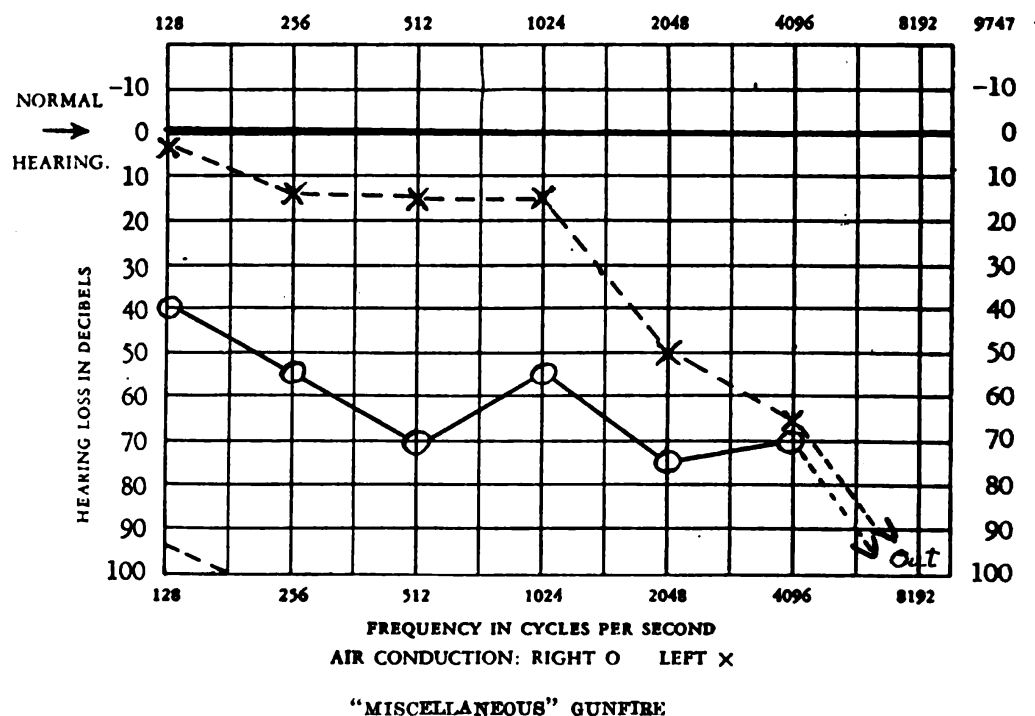
FIGURE 6.—J. J. M., M. M. 1c. Age 31 years. Naval service 13 years. On the U. S. S. *S-35* in 1931 experienced severe trauma while near the 4″ guns. "Felt like I was hit with a sledge hammer." Ears "rang" for 2 weeks. Partial deafness continued. Subsequent tonsillectomy subjectively improved hearing, but still experiences tinnitus occasionally. Had syphilis in 1932, adequately treated. Submarine Diesel engines 96 months. History otherwise negative. Examination reveals marked thickening of right drum with white plaques around the inferior portion. Left normal. Watch tick: right: contact only, left, none. Whispered voice: right 0/15, left 2/15. Spoken voice: right 7/15, left 15/15. Coin click: right 0/20, left 3/20. Rinne: bone conduction greater than air conduction on the right. Physical examination otherwise negative.

demonstrated as being a good safeguard, their use by all the ship's company should be made mandatory. Wax plugs and oil-impregnated cotton plugs have been used. Over-all "ear-muff-type" protective devices have also been used, but are expensive, clumsy, and less satisfactory in general. It is suggested that the use of ear defenders of the type mentioned in parts 1 and 2 of this series would be preferable to cotton plugs, particularly for members of gun crews who have little or no time to replace plugs if they fall out. These crews need added protection due to their proximity to the guns. Considerable work is now being done by various experimenters in the development of more satisfactory ear defenders. The principal defects in those now in use is that if worn for a long time they prove uncomfortable. Considering the possible incidence of bombings to civilian centers as well as military objectives, the following simple practices are recommended for the use of all hands: placing the finger over the external auditory meatus, or opening the mouth when an explosion is imminent. Authorities generally agree as to the desirability of these practices.
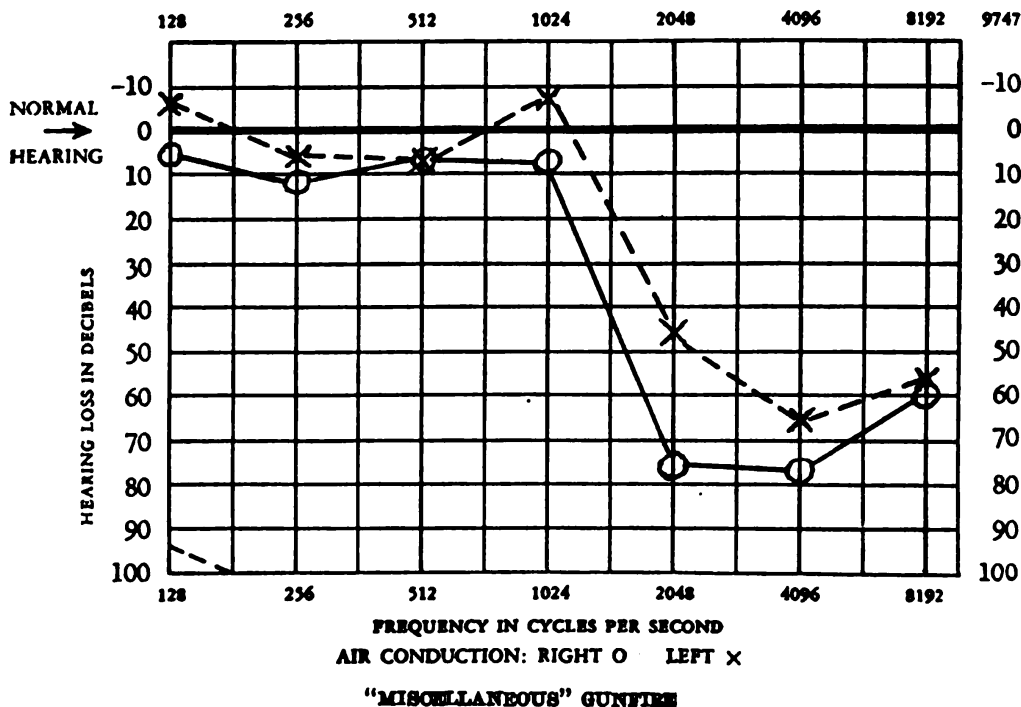
FIGURE 7.—F. M. V., M. M. 1c. Age 39 years. 16 years' naval service. Served 168 months in the engine room of a submarine. On the first burst of a 4" 50-caliber salvo, cotton blew out of his ears. Left ear drum ruptured. Deaf in both ears for a day. Cleared without infection. Progressive deafness for the past 10 years. History otherwise negative. Physical examination shows both drums thickened and retracted. Watch tick: both ears, contact only. Whispered voice: right 6/15, left 2/15. Spoken voice: 15/15 both ears. Coin click: right 8/20, left 10/20. Weber: lateralizes to the right. Physical examination otherwise negative.

"Miscellaneous" Gunfire
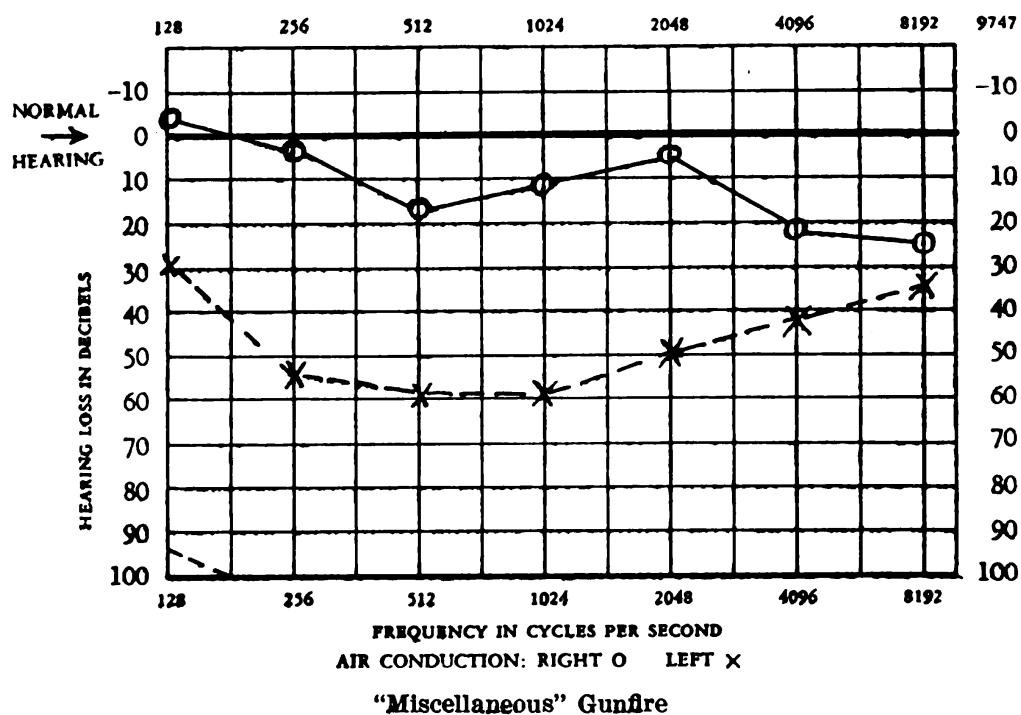
FIGURE 8.—H. Y., M. M. 1c. Age 35 years. 14 years naval service. Served as a machinist's mate for 150 months on a submarine. Severe traumatism by crank-case explosion in 1934—unconscious for a few minutes. For 8 months following had tinnitus and partial deafness in left ear. History otherwise negative. Physical examination: both drums show thickening and marked retraction. Watch tick: right 32/40, left 1/40. Whispered voice: right 15/15, left 6/15. Spoken voice: right 15/15, left 12/15. Weber: marked lateralization to the left. Left bone conduction better than air conduction for 256, 512, 1024 and 2048 cycles. Physical examination otherwise negative.
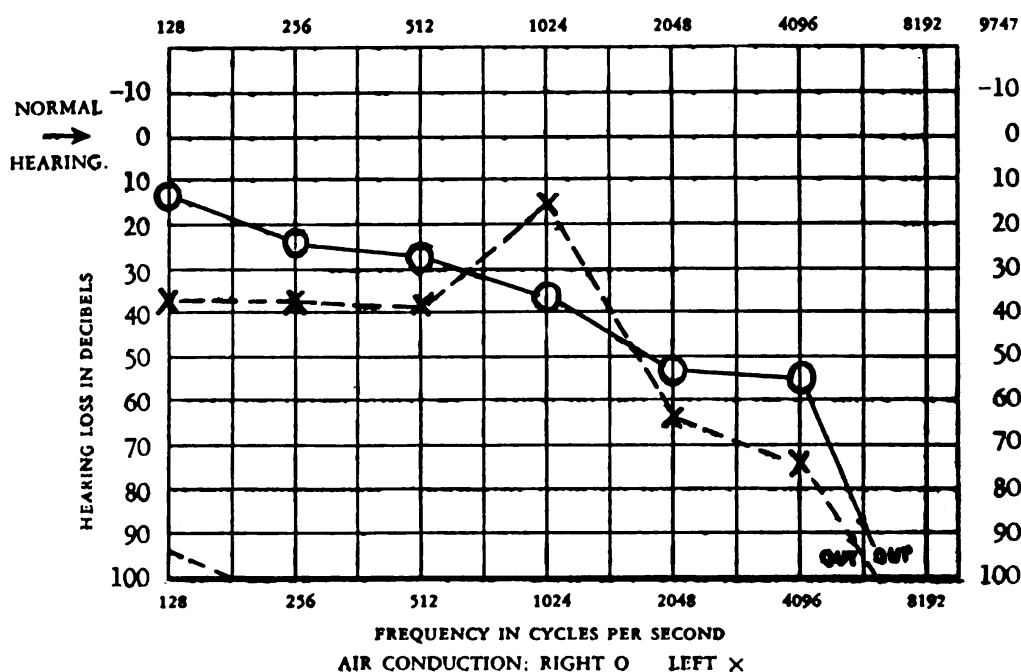
FIGURE 9.—N. H. M., M. M. 2c. Age 26 years. Naval service 4½ years. Submarine duty 36 months. Patient gives a history of being observer in pits during 30-30 rifle fire; removed head phones thinking the firing was over; on another volley, experienced such severe trauma as to cause him to drop the phones and run. Reported to the officer in charge that the pain and ringing in his ears was so intense that he could not stand it. Returned to the ship, treated by the ship's medical officer for months. Eventually referred to a hospital where treatment was continued and tonsillectomy performed—no relief.

Present complaint: progressive deafness and marked tinnitus. Appeared considerably agitated during the examination and complained that he could not stand to listen to the higher frequencies, and that any loud noise was intolerable to him and "hurt his ear drums". He would not hold the receiver up to his ear if the tones were amplified much above his threshold level.

Physical examination: right drum slightly dull, the left dull and retracted. Watch tick 0/40 both ears; whispered voice: right 1/15, left, ½/15; spoken voice: right 15/15, left 6/15; coin click, right 1/20, left ½/20; Weber lateralizes to the right. Rinne positive on right, negative on left.

This case resembles "shell-shock" and seems definitely neurotic.

SUMMARY

A discussion of both "pure" and "miscellaneous" cases showing permanent loss of hearing due to exposure to gunfire has been presented.

Data have been reported showing the loss at the various frequencies and the resulting type of deafness.

Audiograms of individual cases demonstrating this loss are included.

Prevention of this hearing loss being in the best interest of the Navy, several preventive methods have been suggested and evaluated.

Further studies concerning naval hazards to hearing are in progress and will be presented subsequently.

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FIGURE 1.—SHOWS PARALYSIS OF RIGHT SIDE OF FACE.   INSERT SHOWS PARTIAL
IMPACTION OF RIGHT LOWER THIRD MOLAR.

FIGURE 2.—COMPLETE RECOVERY 10 DAYS AFTER EXTRACTION OF MOLAR.

CLINICAL NOTES

FACIAL PARALYSIS

A CASE REPORT

By Lieutenant Commander Arthur Siegel, Dental Corps, United States Navy

On January 17, 1938, W. J. C., age 24 years, was admitted to the sick list with a diagnosis of paralysis of the seventh nerve, right side of face. The patient stated that his symptoms started about a week prior with inability to control the movements of his upper lip. This progressed rapidly upward, causing the upper eyelid to droop, and he was unable to close the right eye. The wrinkles of the forehead on the affected side were flattened and there was a marked deviation of the nose toward the normal side. When the patient smiled the muscles of the normal side pulled those affected toward them, leaving the right half of the face expressionless.

Physical examination revealed no gross pathology. Dental examination revealed no carious or nonvital teeth. There was no evidence of peridontal disease. The right submaxillary gland was definitely enlarged and tender to the touch. Dental x-ray examination revealed an upper and a lower unerupted third molar. The lower tooth was slightly impacted by the ascending ramus but neither of these unerupted teeth presented any evidence of infection (figure 1).

On January 29, 1938, the lower third molar was removed surgically under conduction anesthesia. After extraction, considerable resorption of the apical third of the distal root was noted. Two hours after extraction, the patient stated that he had regained some control of the affected side.

On February 2, 1938, the patient was improved as he could close his eye and wrinkle his forehead.

By February 8, 1938, 10 days after extraction of the third molar, symptoms had disappeared, and the patient returned to duty (see figure 2).

CONCLUSION

The definitely enlarged submaxillary gland and the reabsorbed apical third of the unerupted lower third molar lead to the conclusion that an inflammatory process existed and that this tooth was the etiologic factor, particularly since the symptoms disappeared almost immediately after extraction. It is of interest to note that the sensory branch of the trigeminal was not affected nor was the motor branch of this nerve, for the masseter muscle remained under control.

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GUNSHOT WOUND OF THE HEART[1][2]

FOREIGN BODY IN UNUSUAL LOCATION

By Lieutenant Commander C. C. Myers, Medical Corps, United States Navy, and Lieutenant, junior grade, J. W. Mader, Medical Corps, United States Naval Reserve

Although numerous cases of foreign bodies in the heart have been reported, we believe this case to be of particular interest both because of the large size of the foreign body, and the minimal signs and symptoms shown by the patient.

D. D. G., a healthy white male, age 25 years, was struck in the back by a missile during the Japanese attack on Pearl Harbor on December 7, 1941.

After he had been wounded he was admitted to a hospital with symptoms of dizziness, palpitation and some chest pain. The examining physician found some splinting of the chest on the left side. An x-ray of the chest taken December 8 was reported negative. The symptoms soon subsided, and he was discharged to duty 8 days later.

The patient was able to carry on his normal duties fairly well, except for spells of palpitation lasting several minutes, some nervousness, and occasional dizziness. In January 1942, he was admitted to the sick bay on a combatant ship with these symptoms, and after a period of several days he was again returned to duty.

We saw the patient for the first time on February 24, 1942, when he was admitted to the surgical service of the U. S. S. *Solace* with typical symptoms of acute appendicitis. His white blood count was 12,100 and 80 percent polymorphonuclear leukocytes. Physical examination was otherwise negative except for a well-healed scar about ¼ inch in diameter located about 2 inches to the left of the midline posteriorly, at the level of the seventh thoracic vertebra. An appendectomy was done and an acutely inflamed appendix was removed.

His postoperative course was entirely uneventful. A few days after he was out of bed he reported that he had an occasional mild attack of palpitation lasting several minutes and a mild feeling of discomfort in his chest on moving his arms in certain positions or when bending forward. These symptoms were not constant, nor were they in any way incapacitating. X-ray examination revealed the following findings:

X-ray examination of the chest on March 6, 1942 (3 months after injury) shows no evidence of opaque foreign body or fracture in the dorsal region, but there is a metallic foreign body in the region of the heart about 1.5 by 0.25 inches in size, having the approximate size and shape of a 30-caliber bullet; the long axis of the bullet lies anteroposterior with its apex directed anteriorly and its tip within approximately one-half inch of the anterior wall of the thoracic cavity; it is located about 0.75 inch above the diaphragm and 1.25 inches to the left of the midline; the plane of the bullet is about 1 inch below the posterior wound of entrance. Confirmatory radiographs and roentgenoscopy show movements of the bullet to be synchronous with and of apparently the same amplitude as the ventricular contractions. In all postures (including erect, prone, supine, obliques, laterals and exaggerated Trendelenburg) there is no change in the bullet's position relative to the heart, and its movements synchronous with the heart beat remain constant. The location and behavior of the bullet indicate that it is at least partially embedded in the myocardium of the right ventricle; its base may be protruding into the ventricular cavity. There is no definite ab-
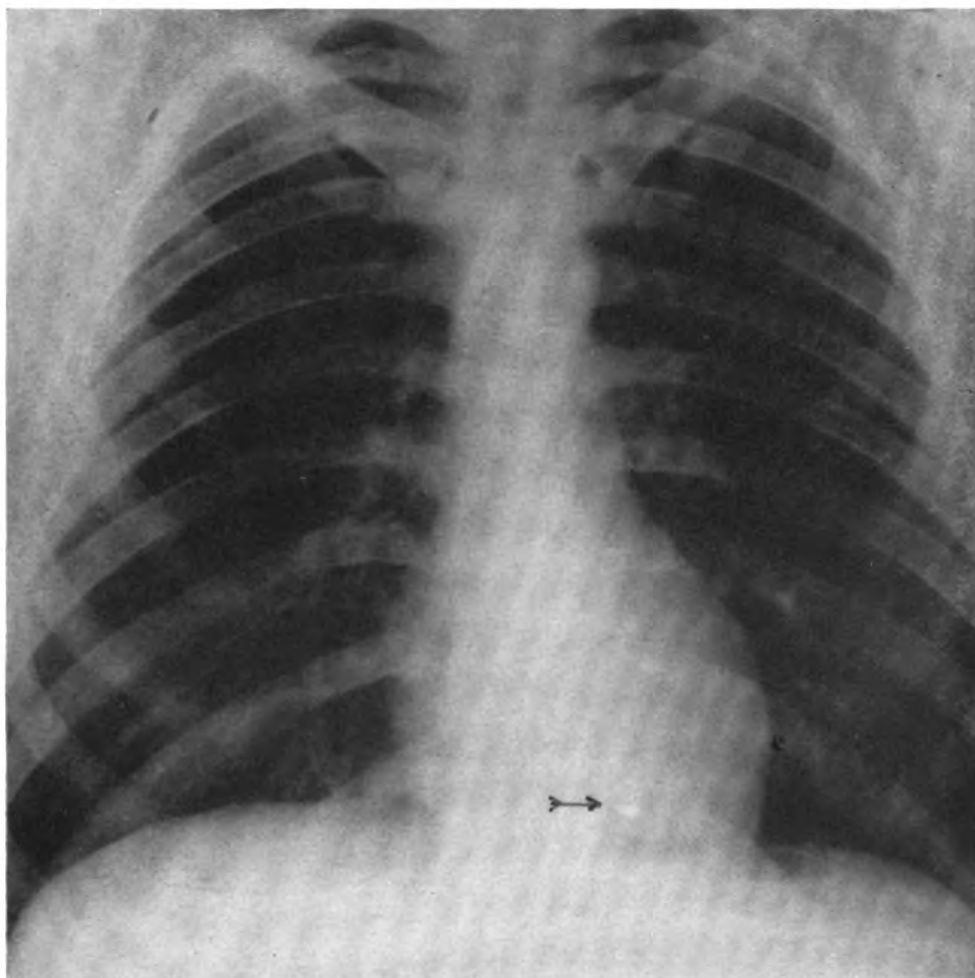
FIGURE 1.—ANTERIOR-POSTERIOR PROJECTION SHOWING BULLET IN HEART.
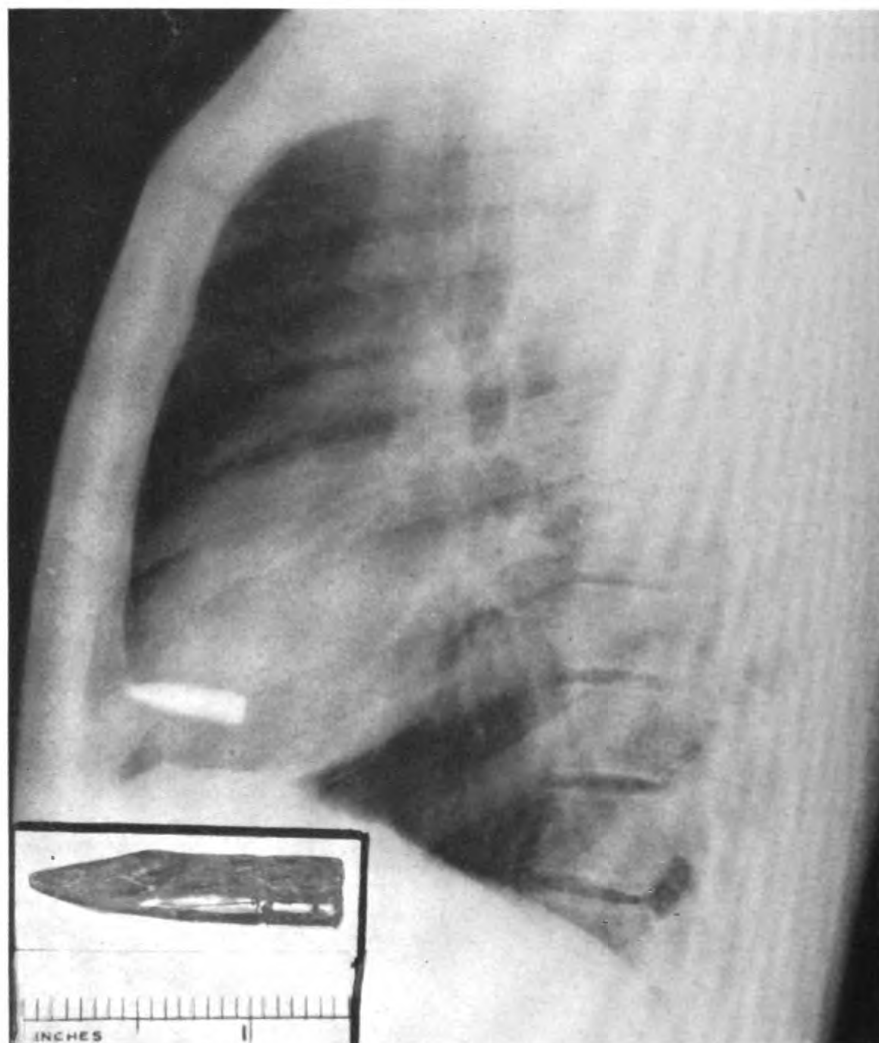
FIGURE 2.—LATERAL PROJECTION SHOWING LOCATION OF BULLET   INSERT SHOWS
SIZE OF BULLET AFTER REMOVAL.
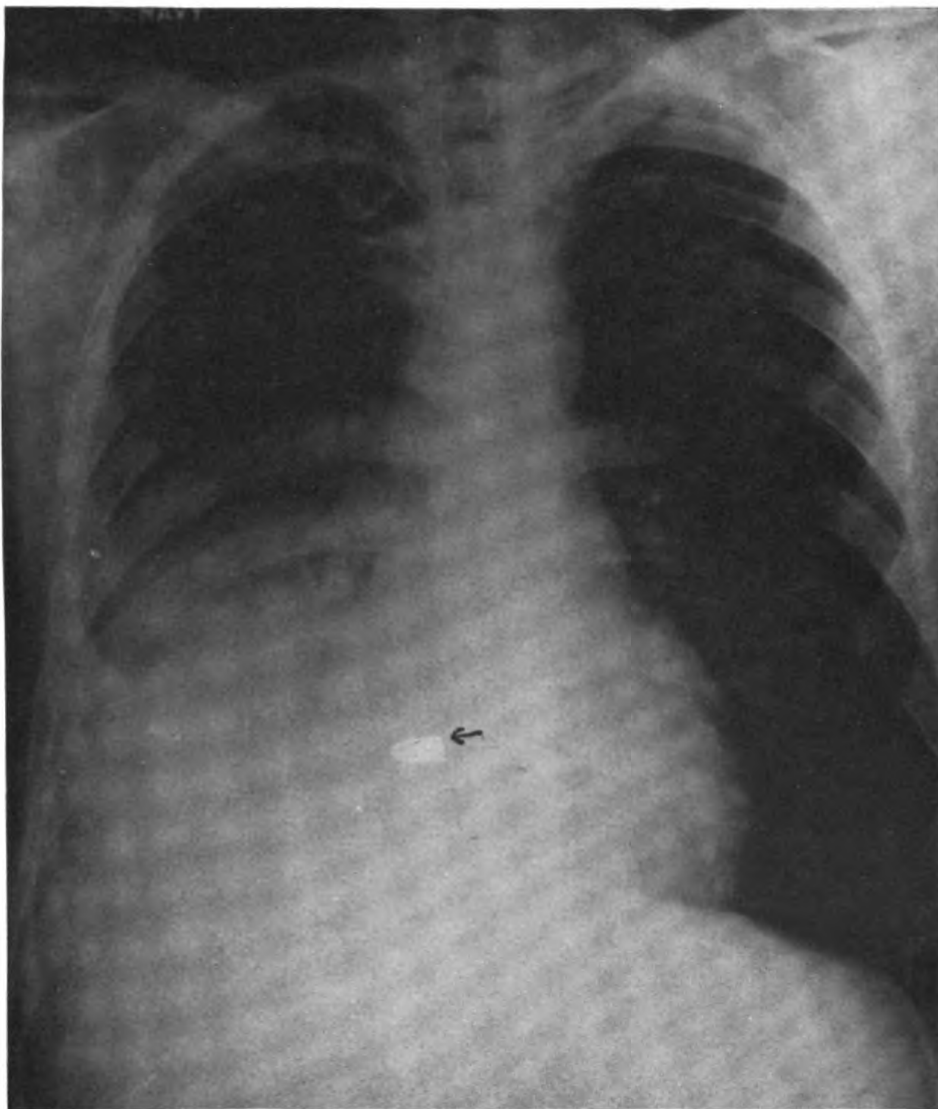
FIGURE 3.—ANTERIOR-POSTERIOR POSITION SHOWING FOREIGN BODY.
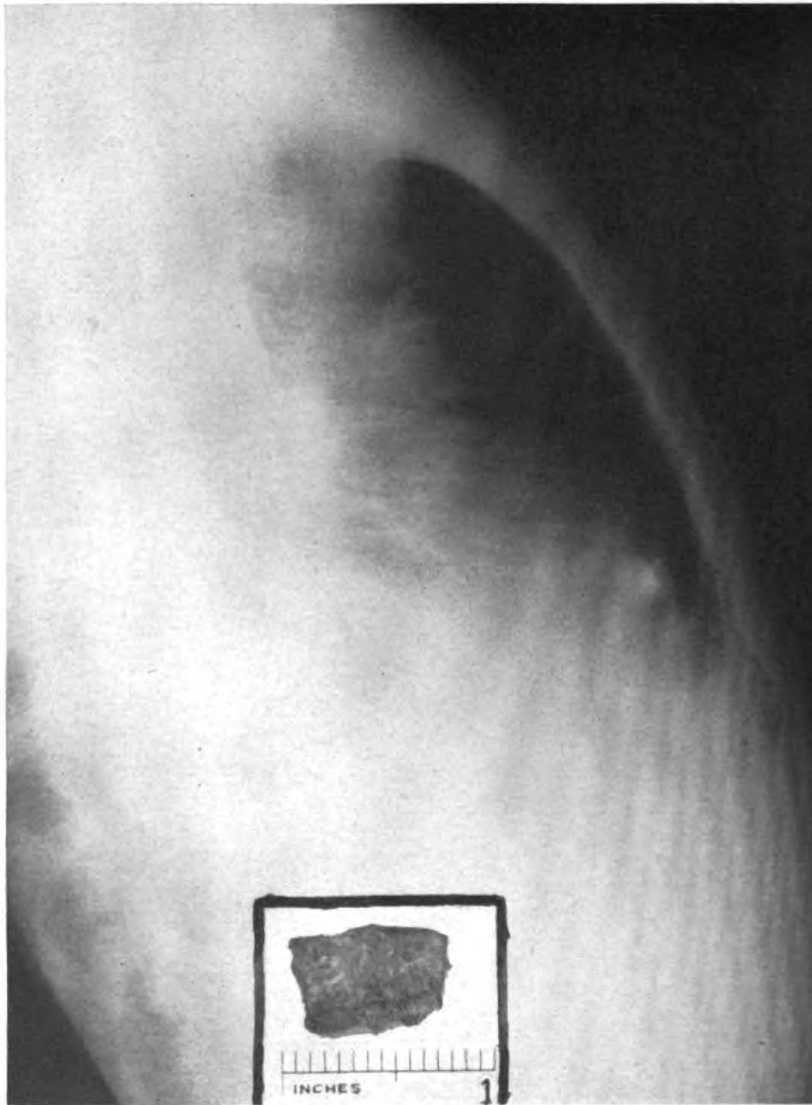
FIGURE 4.—LATERAL POSITION SHOWING SHADOW OF FOREIGN BODY. FOGGY
    SHADOW DUE TO MOVEMENT OF HEART. INSERT SHOWS SIZE OF FRAGMENT
    REMOVED.

normality of the cardiac size or contour, no evidence of blood in the pericardium, and no apparent pulmonary pathology now existing, although the bullet must have traversed the lung, the pericardium and the myocardium posteriorly in order to have reached its present position. Reproductions of two of the radiographs are shown in figures 1 and 2.

Following roentgenological studies, his heart and lungs were repeatedly reexamined by various members of the staff and no deviation from the normal was found. Several electrocardiograms were taken and all were entirely normal.

Due to the exigencies of the service, it was necessary to evacuate this patient from the hospital ship a few days after the condition was discovered.

GUNSHOT WOUNDS OF THE HEART [1]

SUBSEQUENT REMOVAL OF FOREIGN BODIES

Two Case Reports

By Lieutenant Commander Emile Holman, Medical Corps, United States Naval Reserve

CASE I

D. D. G., age 25 years, entered Mare Island Naval Hospital, March 30, 1942, complaining of dizziness, faintness, and shortness of breath on exertion. Ordinary activity, such as walking on the level, produced no symptoms.

He entered the Navy on September 26, 1940, and considered himself perfectly well until the battle of Pearl Harbor, December 7, 1941. On that day he was aboard ship when it was struck by a bomb. The next thing he remembered he was swimming in the water, and being picked up by a small boat. As he climbed into the boat, he collapsed, and remembered nothing more until the next day when he awoke in the hospital. He remembered being very short of breath, panting "like a dog" as he lay quietly in bed. The slightest movement produced pain in his chest. An anteroposterior roentgenogram of the chest was taken but no foreign body was discovered at that time. A small dressing on his wound in the back fell off on the 5th day and was not replaced. About the 5th day, his breathing was greatly improved, and he was allowed out of bed on the 6th day. On the 8th day, he was returned to duty and with his ship went to sea. He had attacks of faintness and dizziness, accompanied by sudden and momentary blacking out of vision, which occurred with or without exertion, but particularly on climbing the ship's ladders, or when rising suddenly from a sitting or stooping position. A diagnosis of hyperthyroidism was made because of dizziness, nervousness and rapid pulse.

He remained on duty for 35 days, when he was transferred to another vessel. Here his symptoms were listed as "nervousness, lack of appetite, loss of weight, increased sweating, and dizziness on standing up suddenly." He also experienced palpitations of the heart, dropped beats, and extra systoles. Physical examination was negative at that time except for a "slight tremor of the heart." His pulse and blood pressure were recorded as "normal." A diagnosis of "psychoneurosis and hysteria" was made, and he was returned to duty.

However, he was unable to do his work, and again he was transferred to another ship where he suffered an attack of appendicitis. Under spinal anesthesia, his appendix was removed on the U. S. Hospital Ship Solace. Blood pressure was recorded here as 112/72. A roentgenogram was taken on March 7, 1942, disclosing a bullet in the region of the heart. The radiologist's report is a model of completeness:

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[1] Received for publication June 9, 1942.

"Fluoroscopy and films of the heart reveal the bullet to describe a dancing rotary movement with each cardiac pulsation, the motion of the posterior end of the bullet being of slightly greater amplitude than its tip. With each pulsation it also moves upward toward the base about ½ cm. In all postures, right and left lateral, recumbent, prone, supine, oblique and exaggerated Trendelenburg, there is no shifting of position of the bullet, but the motions, synchronous with the heart beats, remain constant. The size and contour of the heart are normal, and there is no evidence of free fluid in the pericardial sac; neither is there any residual evidence of pulmonary abnormalities. The position and behaviour of the bullet leads to the conclusion that it is at least partially imbedded in the myocardial muscle near the apex."

From the U. S. Hospital Ship *Solace* he was transferred to Pearl Harbor where a blood pressure of 140/84, and a pulse rate of 82 were recorded. He was sent to Mare Island on board ship, under the care of Commander D. W. Lyon, Medical Corps, United States Navy.

On admission at Mare Island Naval Hospital he was still short of breath on exertion, and quite dizzy on assuming the erect posture suddenly. He also had occasional sharp stabs of pain in his left chest. On physical examination, the patient appeared to be a perfectly well young man of good color and excellent nourishment, with a temperature of 98.6° F.; pulse, 88; respirations, 18; and blood pressure, 110/70. There was a small oval healed scar on the posterior left thoracic wall, 3 cm. below the angle of the scapula. The heart was not enlarged. There was no murmur or friction rub to be heard. The electrocardiogram was normal. A roentgenogram (figs. 1, 2) was interpreted by Lieutenant Alexander Petrelli as showing the bullet in the region of the apex in the interventricular septum.

On April 17, 1942, the operation for the removal of the bullet was performed by the author under gas anesthesia. A curved incision was made to the left of the midline.

About 8 cm. of the fourth rib was removed together with its costal cartilage and the costal cartilages of the third and fifth ribs. An incision in the posterior periosteum and triangularis sterni muscle was made, paralleling the sternal border about 2 cm. lateral to it, revealing the underlying pericardium. The pleural cavity was not entered at any time during the operation. The pericardium, which appeared normal, was incised between two previously placed sutures. There were no adhesions, nor fluid in the anterior pericardial sac. In the midportion of the exposed anterior surface of the heart directly over the interventricular septum was a round discrete, elevated button of pink fibrous tissue, surmounted by a glistening endothelium, in the center of which could be felt the tip of the bullet lying about 8 mm. below the heart's surface. The nubbin of fibrous myocardium was incised. The bullet lay encased in a tough fibrous wall about 1½ mm. thick. This was incised and the bullet grasped with a forceps. Traction on the forceps lifted the heart completely out of its bed, but failed to dislodge the bullet, presumably due to the creation of a vacuum behind it. Tugging on the bullet produced extreme irregularities in cardiac action. Several rather vigorous attempts at removal were unsuccessful. These were done not without considerable trepidation lest the withdrawal of the bullet be followed by uncontrollable bleeding. Several cotton sutures had been placed paralleling the incision in the myocardium for control of the bleeding by cross pulling should it occur. A grooved director was then passed alongside the bullet, admitting air back of it, thus permitting its prompt and easy removal. There was no bleeding of consequence.

Sulfathiazole was introduced into the cavity left by the bullet, following which the fibrous myocardium was closed with four interrupted cotton sutures. The pericardium was incompletely and loosely closed with two sutures so as to permit any blood or inflammatory fluid to escape into the mediastinum, thus avoiding the possibility of cardiac tamponade. The wound in the chest wall was closed in layers with cotton sutures without drainage.

Following the operation, an oxygen tent was kept handily near, but was not used. For 5 days the temperature ranged between 100.4° F. and 99.8° F., but by the 6th day it was normal and remained so. The pulse rate for 5 days lay between 118 and 114, when it, too, reached a normal of 64 to 80.

An electrocardiogram taken on the day of operation, instead of being perfectly normal as before, showed a sinus tachycardia; T_1 was lower, and T_2 had a late inversion. On the day following operation, the pulse rate was 105, and an electrocardiogram showed that "T_1 and T_2 had become elevated. The conduction times were normal and unchanged. The T-wave changes were those seen with anterior myocardial abnormalities. The S–T intervals resembled those produced by pericarditis." On April 21, the physician in chief reported a normal electrocardiogram. The patient at the present time is an ambulatory convalescent at the hospital.

CASE 2

B. J. B., age 21 years, was admitted to Mare Island Naval Hospital on December 26, 1941, with bomb fragment wounds of right chest, right elbow, and right leg. While serving on a vessel at Pearl Harbor, he was struck in three places by flying fragments. He was able to walk to C. P. O. quarters aboard ship, but after lying down does not remember anything until the following evening. At the Naval Hospital, Pearl Harbor, an oxygen mask was necessary for the first 3 days. Pains in the chest and difficulty in breathing were his chief complaints at that time. A diagnosis of hemothorax was established but not treated. He gradually improved, however, and he had no particular complaints when admitted to Mare Island Naval Hospital.

Physical examination here revealed restricted movement and impaired resonance of the right chest with a temperature of 99° F.; pulse, 72; respiration, 18. He remained in bed for 2 weeks following which there were no complaints and all wounds were healed.

On January 13, 1942, a roentgenogram showed some fluid still present in the right chest (figs. 3, 4). A jagged-edged foreign body about 1.5 cm. in diameter was disclosed lying 2 cm. to the right of the midline, posterior to the fourth interspace, about 8 cm. inside the chest. There was no fever.

On January 23, 1942, the operation for removal of the foreign body, presumably in the lung, was undertaken by the author. This decision was made not because of present trouble, but as a preventive of later difficulty which might result from the migration of the metal fragment or to its involvement in inflammation. Although small fragments may be disregarded, it was felt, because of the size, weight, and jagged character of this fragment, its removal was warranted.

Before operation the patient had not been examined fluoroscopically, which we subsequently regretted. Careful scrutiny of the roentgeno-

gram after the operation showed three superimposed shadows of the
foreign body due to movement during the short exposure in taking the
roentgenogram. This was considered positive proof that the foreign
body moved with beating of the heart, and not with movement of the
lung, as was the original interpretation. The lesson is obvious:
fluoroscopy is essential in the accurate localization of all foreign bodies
within the chest.

On opening the pleura no free fluid was encountered, but wide-spread filmy
adhesions were found between the lower lobe and the parietal and diaphragmatic
pleura. Palpation of the lung did not, disclose any foreign body, and it was at
once apparent that the trail of the fragment led toward the heart, where it could
be palpated within the pericardium. A large circular defect was seen in the
right lateral surface of the midpericardium about 2 cm. in diameter filled with
fibrinous exudate. This was enlarged toward the base, disclosing the origin
of the aorta with a mass of fibrinous exudate overlying it, in which was em-
bedded the foreign body. It appeared to lie at the base of the heart immediately
between the aorta and the right auricle. The channel of entrance was enlarged
by spreading with a clamp. The foreign body was gingerly withdrawn with con-
siderable apprehension lest its removal be followed by bleeding. None occurred.
A culture of the bed was taken, which subsequently proved sterile. One gram
of sulfanilamide was placed in the pocket from which the foreign body was
removed. The pericardium was not closed so that any inflammatory fluid might
escape into the pleural cavity instead of accumulating in the closed pericardium,
with the production of cardiac tamponade.

The wound in the chest wall was closed in layers with cotton sutures, and an
airtight closure was obtained, followed by primary healing.

The postoperative course was uneventful except that in the first 3
days there occurred several episodes of paroxysmal tachycardia accom-
panied by marked dyspnea. An oxygen tent provided prompt relief
each time. He was discharged to ship duty, February 14, 1942. Three
days later he apparently contracted a cold and was readmitted to Mare
Island Naval Hospital with a fever of 101° F., pulse 110–140, respira-
tions of 30, and pains in the right lower chest, with evidence of fluid at
the right base. Under simple bed rest and sulfathiazole all signs and
symptoms slowly disappeared.

THE TREATMENT OF SUPERFICIAL BURNS WITH MICROCRYSTALLINE SULFATHIAZOLE [1]

By Commander Camille M. Shaar, Medical Corps, United States Navy; Lieutenant Commander
L. Kraeer Ferguson, Medical Corps, United States Naval Reserve; and Lieutenant, junior
grade, Philip L. Nova, Medical Corps, United States Navy

The treatment of superficial burns has proved so satisfactory with the
use of microcrystalline sulfathiazole that it seems worthwhile to present
a brief preliminary report of its results. The preparation of the micro-
crystals by crystallization over a high-frequency vibrator was devised

by Dr. Leslie A. Chambers; this will be published in detail elsewhere. The method produces uniform crystals in which the particles are approximately one-twentieth the size of the ordinary crystals or powder particles. The advantages of the microcrystals over the usual powdered sulfathiazole are the increased rapidity of solution, due to the increased surface exposed, and the absence of the clumping so frequently seen when the ordinary powder is used.

Sulfathiazole has proved more effective against the wide range of organisms that are found infecting burns than the more soluble sulfanilamide. It lasts in effective concentrations as long as 4 or 5 days after a single application. It may be used over long periods of time, 3 to 4 weeks, without producing the unhealthy edematous granulations commonly seen when sulfanilamide crystals are used.

The technic we have followed is simple. The burned patient is given an adequate dose of morphine sulfate, and the burned area is cleaned up by removing all loose superficial skin and blebs. The area is then sprayed with microcrystalline sulfathiazole, using a powder insufflator, until the area is thinly dusted with the white powder. The burned area is then covered with gauze, which is snugly bandaged in place. An effort is made to apply the bandage tight enough to apply pressure and thus to prevent edema and loss of fluid into the tissues. Splints are applied for burns of the upper extremity. In burns of the lower extremity, the leg is elevated on pillows for several days. The dressings are moistened with physiological saline solution two or three times daily. Dressings are changed and the burns redressed with sulfathiazole as above every third day.

The results obtained with this method of treatment have been most favorable:

1. The pain associated with the burn is relieved almost at once. Even with burns involving the entire face, ears and neck, no sedative was necessary except the original dose of morphine given before debriding the burned area.

2. The burned area is clean and healthy from the first. There is a striking absence of the heavy secretion usually noted, even in areas of third-degree burn.

3. Healing is in no way retarded; rather, in comparison with other methods of treatment, it is more rapid. Granulation tissue appears early in areas of third-degree burns. It is a healthy, brilliant crimson color, and makes possible the early application of skin grafts.

We have used this method in several cases of burns which were tanned before they came under our care. Our results with these lesions in regard to relief of pain and rapid progress of healing have been equally good. We believe this is the most efficient method of preparing old areas of granulations for skin grafting. Even when the entire burned area is not ready for grafting, it is often possible to graft some of the granulating wound, and the application of sulfathiazole does not seem to affect the "taking" of the graft.

CASE REPORTS

Case 1.—S. B., age 23 years. This patient was admitted to the hospital after a gas field stove had exploded while he was working near it. No preliminary treatment of any type had been given prior to admission.

Examination revealed extensive first- and second-degree burns of the face, neck, ears and right wrist (figure 1). The skin was hanging in loose shreds over the burned areas, and large blebs had already formed.

The patient was given ¼ gr. morphine sulfate on admission. Shortly afterward, a thorough debridement of the burned areas was done, care being taken to remove all loose superficial skin and blebs. The raw surfaces were then dusted with microcrystalline sulfathiazole powder, using an ordinary insufflator, and covered with fine-mesh sterile gauze and bandaged. The dressings were moistened every 2 hours with warm physiological saline solution.

The patient was comfortable almost immediately after the treatment was instituted, and no further sedation was needed. The dressings were changed on the third day and the microcrystalline sulfathiazole reapplied. After the sixth day, dressings were no longer used, the only treatment being the use of the sulfathiazole powder. The temperature was 99.4° F. on the third day, but dropped to normal the following day. Healing progressed rapidly and an excellent cosmetic result was obtained (fig. 2).

Case 2.—H. E., age 23 years. Three weeks prior to admission to the hospital this patient had fallen against a camp heater and sustained a severe third-degree burn on the posterior surface of the right lower leg. Various preparations had been used in the treatment, but the area had become infected and had remained unhealed.

When examined, he was found to have an ulcerating area about 4 cm. in diameter and 1 cm. in depth on the posterior surface of the calf of the right leg. The base and edges were covered with firmly adherent necrotic tissue, and there was a considerable amount of purulent discharge. There was no evidence of granulation.

Treatment consisted in a thorough cleansing and irrigation of the part with saline solution, and removal of as much of the devitalized tissue as possible. Microcrystalline sulfathiazole powder was placed in the wound and the patient put to bed with the leg elevated. The dressings were kept moistened with warm saline solution and changed daily. Each time the dressings were changed, sulfathiazole powder was reapplied, and more of the necrotic tissue was removed until the base of the ulcer presented a good clean granulating surface. Finally, a full-thickness skin graft was applied.

Case 3.—R. M., age 29 years. This patient was admitted 3 hours after having sustained a third-degree burn involving the palmar and dorsal surfaces of the right hand and wrist. A paint brush soaked in gasoline, which he was holding in his hand, was ignited accidentally. Examination revealed an extensive third-degree burn of the right wrist, palm and dorsum of the hand and all the fingers. There was considerable oozing of serous exudate, and bleb formation over the entire area. The patient complained of intense pain.

Following the administration of ¼ gr. morphine sulfate, the loose skin and blebs were removed, and microcrystalline sulfathiazole powder was dusted over the entire area, covered with sterile gauze, and bandaged. These dressings were kept moist with warm physiological saline solution, and the hand and arm were placed in a splint. For the first 5 days, the dressings were changed daily, but subsequently only every third day. Each time the dressings were changed, the sulfathiazole was applied in the usual fashion. Healing progressed rapidly and a good functional result was obtained.

FIGURE 1.—CASE 1. APPEARANCE ON DAY AFTER ADMISSION.
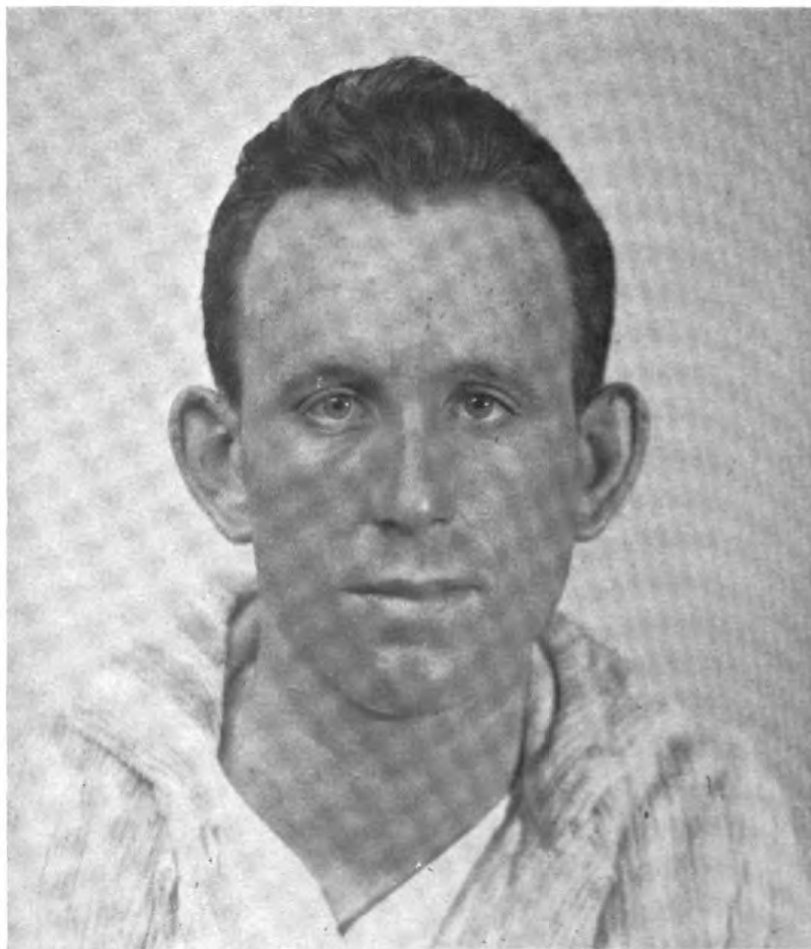
FIGURE 2.—CASE 1. APPEARANCE 20 DAYS LATER.

SUMMARY

A microcrystalline preparation of sulfathiazole applied as a powder with an insufflator and overlaid with wet saline dressings has proved most effective in the treatment of early and late burns. The absence of any evidence of infection, the almost immediate relief of pain and the possibility of early skin grafting have been the outstanding advantages of the method. Sulfathiazole was used because of its wider range of usefulness against the organisms infecting burns, and in the microcrystalline form it does not clump or cake. Its prolonged use, even 3 to 4 weeks, is not followed by the appearance of unhealthy granulation tissue.

TYPHOID SPINE [1][2]

By Lieutenant Commander Paul E. McMaster, Medical Corps, United States Naval Reserve

Typhoid fever, although less common today than a number of years ago, is by no means extinct and, as this infection of the spine may cause symptoms years after the active disease, typhoid spine should be considered in a differential diagnosis of spinal lesions. Four cases of typhoid spine are herein reported.

Gibney in 1889 read a paper on "The Typhoid Spine" before the American Orthopedic Association and this is credited with being the first report of the condition. He described the condition as a "perispondylitis or an acute inflammation of the periosteum and the fibrous structures which hold the spine together."

Following the original article by Gibney, numerous articles appeared in the literature by; Lord (18), Cutler (3), Halpenny (12), Elkin and Halpenny (4), Carnett (2), Rugh (26), and Murphy (22) (23). Among more recent writers on this subject are Galli (7), Moffat (21), O'Donnell (24), Turner (30), Keith and Keith (15), Margolis (19), Schmorl (28), Pozzi (25), Gambee (8), Freedman (6), Swart (29) and Veal (31).

Four hundred and ten admissions of proven typhoid fever between the years 1928 and 1936 at the Los Angeles General Hospital were reviewed to ascertain the frequency of typhoid spine. Thirty-five of these cases complained specifically of pain in the back during the acute disease. The backache disappeared in all, after subsidence of acute symptoms and none returned later with a painful back except one. Judging from this series, typhoid fever may cause acute pain in the spine, but the occurrence of typhoid spine as recognized by late symptoms and positive physical and radiographic findings is not common.

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The diagnosis of typhoid spine is made by a history of typhoid fever, with backache occurring either during or immediately after the acute disease, when the patient becomes ambulatory. It may not occur for weeks or months later. Temperature and white blood count are usually normal. The Widal test, if positive, is helpful, but it may be negative. (Bohmansson (1) claims the Widal test may be negative even if multiple bony foci of typhoid infection exist). The physical findings reveal localized spinal tenderness, muscle spasm and limited spinal motions. Rarely scoliosis and kyphosis may be present. Radiographic findings are most commonly localized to two vertebrae, and these usually in the lower dorsal or lumbar spine. The intervertebral disk is narrowed or absent. There is irregular density of adjacent vertebral body borders, suggesting a low grade osteitis, but with only slight, if any, destruction of the bodies. Periosteal and perispinal ligament ossification is not infrequent and may lead to complete bony bridging between vertebrae. Schmorl (28) has described an unusual case with destruction of a vertebral body, but with preservation of the adjacent intervertebral disks. Abscess formation is not common in typhoid spine.

The differential diagnosis of typhoid spine includes, in addition to the more common spinal lesions, coccidioidal granuloma (20), and undulant fever spondylitis which may present similar changes to those of typhoid (17) (27) (13) (11). The diagnosis of the latter is made by history and serologic tests.

Bacteriological studies of the disease have not been frequent as the lesions are deep-seated and abscess is uncommon. Two cases of typhoid spine are reported, one each, by Turner (30) and Freedman (6) with associated abscesses which yielded cultures of typhoid bacilli from the surgical drainage. Murphy (22) quotes Fraenkel who examined the marrow from vertebrae of 10 autopsy cases of typhoid fever and in each typhoid bacilli were cultivated, being most frequent in lumbar vertebrae. Elliott (5) and Wentworth (32), each mentioned that typhoid bacilli may remain latent and even multiply in bone marrow long after the general infection has subsided. Wentworth states that typhoid organisms have been found viable in cortical abscess cavities of bone as long as 45 years after the general infection.

Rugh (26) reported pathological studies on one case of typhoid spine, as follows:

Portions of 2d, 3d, and 4th lumbar vertebrae on ventral side excised. The intervertebral disk between the third and fourth vertebrae was missing and apparently replaced by a bony overgrowth that closely resembled grossly the bony tissue of the vertebral bodies. Sections cut from this point showed a complete absence of cartilage tissue and a marked overgrowth of dense connective tissue with rich blood supply which completely bridged the gap sufficiently to cause ankylosis.

Treatment of typhoid spine has usually consisted of bed rest and immobilization with either plaster casts or back braces. Henderson

FIGURE 1 (CASE 1).—NARROWED DISC BETWEEN THIRD AND FOURTH LUMBAR
VERTEBRAE. IRREGULARITY IN DENSITY AND OUTLINE OF THE ADJACENT VER-
TEBRAL BORDERS AND DECREASED HEIGHT OF FOURTH LUMBAR VERTEBRA.
SLIGHT MARGINAL PROLIFERATION OF BONE PRESENT.
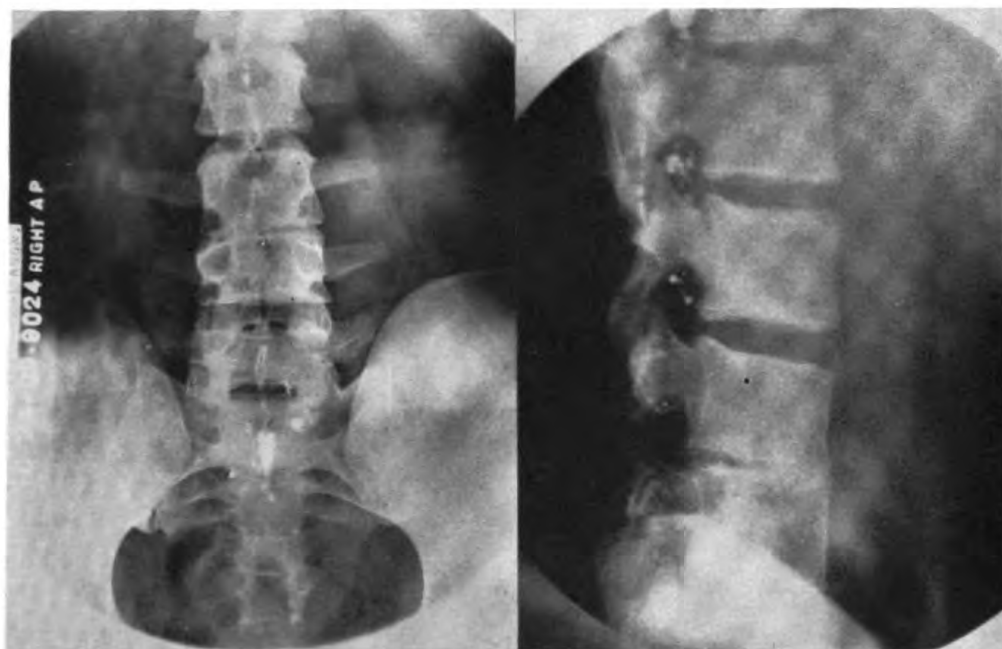
FIGURE 2 (CASE 1).—FUSION OCCURRING BETWEEN VERTEBRAL BODIES ONE YEAR
AFTER SPINAL FUSION. PATIENT WAS SYMPTOMFREE WITH NORMAL ACTIVITY.
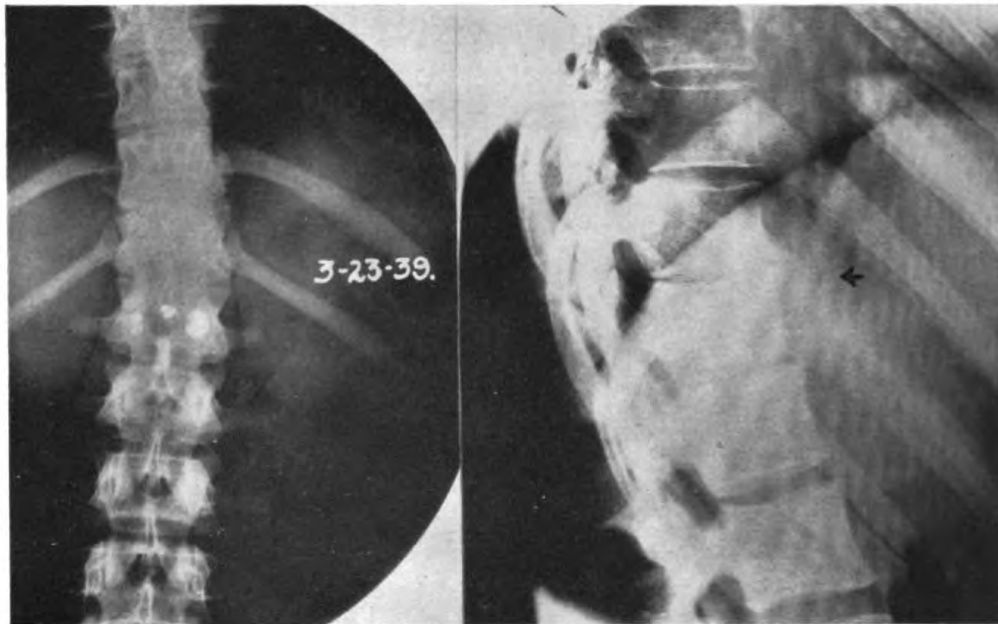
FIGURE 3 (CASE 2).—SCOLIOSIS AND SLIGHT KYPHOSIS WITH NARROWED DISCS
BETWEEN ELEVENTH AND TWELFTH DORSAL AND FIRST LUMBAR VERTEBRAE.
MARGINAL PROLIFERATION OF BONE. DECREASED HEIGHT OF LATERAL AND
ANTERIOR PORTION OF TWELFTH DORSAL VERTEBRA.

FIGURE 4 (CASE 2).—NARROWED CARTILAGE SPACE AND IRREGULARITY IN DENSITY
AND OUTLINE OF FEMORAL HEAD (L). SOME MARGINAL PROLIFERATION OF
BONE. TYPHOID ARTHRITIS.
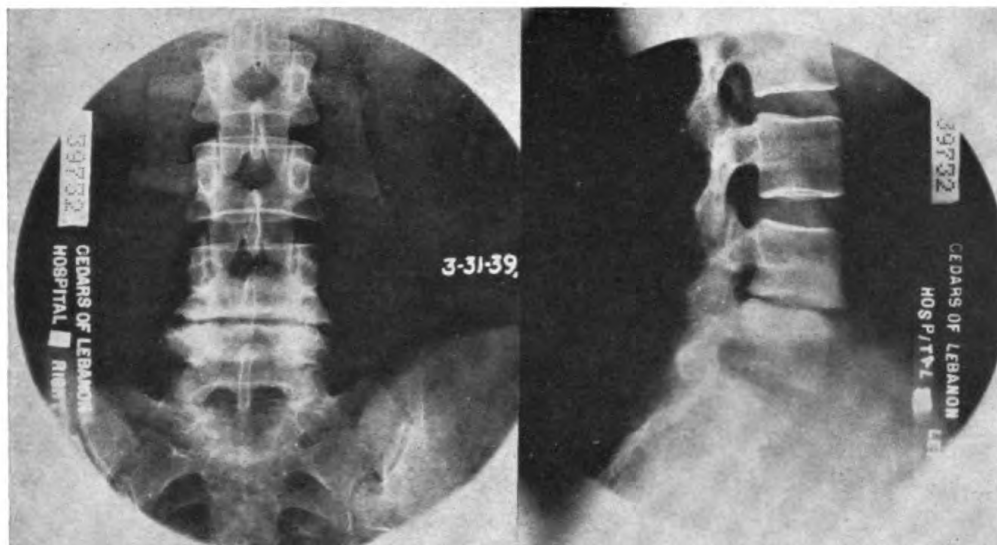
FIGURE 5 (CASE 3).—NARROWED DISC BETWEEN FOURTH AND FIFTH LUMBAR VER-
TEBRAE. IRREGULARITY IN DENSITY AND SOMEWHAT OF OUTLINE OF ADJACENT
VERTEBRAL BORDERS. MARGINAL PROLIFERATION OF BONE.
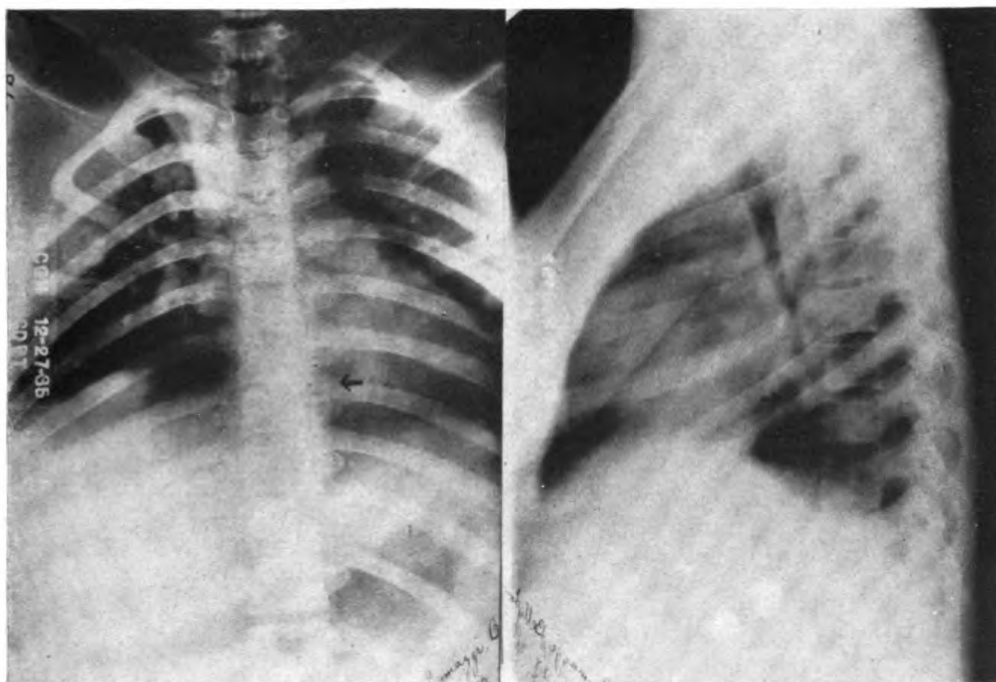
FIGURE 6 (CASE 4).—SLIGHT SUGGESTIVE IRREGULARITY IN OUTLINE OF ADJACENT
VERTEBRAL BODY BORDERS BETWEEN SEVENTH AND EIGHTH DORSAL VERTE-
BRAE. THESE FINDINGS WERE PRESENT THREE MONTHS AFTER THE ACUTE
DISEASE AND WERE AT SITE OF PAIN AND LOCALIZED TENDERNESS

stated that, "We do not operate in these cases as we do for tuberculosis of the spine." He stated further that, "* * * the disability may extend over a long period of time, but the tendency is for the condition to improve gradually." Patients with typhoid spine, however, are apt to have repeated, recurrent attacks of painful back with periodic and at times prolonged disability, hence it appears to the author that in such cases spinal fusion is indicated. Those lesions giving rise to only occasional or minimal symptoms should not require surgery while in others, with serious systemic lesions, surgery is contraindicated. Treatment by rest and back brace is preferable.

CASE REPORTS

CASE I

History.—A colored male, age 24 years, was admitted to the clinic June 24, 1938. His chief complaint was low back pain, present for 3 months, with radiation into right leg. There had been repeated attacks of low back pain since 1933 following a severe siege of typhoid fever. Pain would occur after strenuous exertion. requiring bed rest for from 1 day to 2 weeks.

Examination.—The physical examination was essentially negative except for lumbar muscle spasm, limited spinal motions and tenderness to percussion over the lower lumbar spine. Temperature was 99.2° F. Pulse 76. Radiographic studies of the lumbar spine revealed narrowing of the disk between lumbar 3 and 4 with irregularities in density and outline of the adjacent borders of these vertebrae. There was some decrease in height of the fourth lumbar vertebra. There was slight marginal proliferation of bone (fig. 1). The patient was admitted to the hospital September 12, 1938, where spinal fluid tests revealed: Protein of 25 mg. per 100 cc.; cell count of 0, and negative Wassermann. Both air and lipiodol myelographic studies were negative. Blood count and urinalysis, negative. Blood calcium 12 mg. per 100 cc. Phosphorus, 4.7 mg. per 100 cc., and phosphatase 1.6 units. Two Widal tests, 1 week apart, gave complete agglutination in dilutions of 1–160. Bile obtained by duodenal intubation and stool cultures were negative for typhoid bacilli.

A spinal fusion of lumbar 4 and 5 was done October 1, 1938. He wore a plaster cast for 4 months, and then a Taylor back brace for 7 months. Fusion occurred (figure 2), and in the summer of 1941 he had been and was normally active, and had no pain or discomfort in the back.

Comment.—This patient had a history of typhoid fever, followed by persistent pain in low back. Widal tests were positive and there was no history of typhoid immunization procedures and no other serious illnesses during the previous 5 years. These facts with the radiographic changes established the diagnosis of typhoid spine.

CASE II

History.—A white female, age 28 years, was first seen March 23, 1939. Complaints were painful back and discomfort in left hip. She had had typhoid fever with a positive Widal test in 1934, during which she had pain in the left hip, but this improved. Pain developed in the midback when she became ambulatory, which persisted and had caused considerable disability with frequent attacks of severe pain requiring bed rest for relief. The pain interfered greatly with her sleep, was worse during cold, damp weather, and each morning the back felt stiff.

She had had some pain and discomfort in the left hip at irregular intervals—usually during cold damp weather.

The past history was essentially negative, with no serious injuries; she had had measles, mumps, and chicken pox in childhood; and typhoid fever in 1934, prior to which she had had no typhoid fever immunization. Marital and family history irrelevant.

Examination.—The physical examination revealed tenderness to percussion over the eleventh and twelfth dorsal and first lumbar vertebrae. There was a mild left dorsolumbar scoliosis and a suggestion of kyphosis. Forward and backward bending of spine was somewhat limited by muscle spasm and pain as was lateral bending. The left hip moved normally in flexion and extension, but there was limitation of internal and external rotation and these latter motions, when forced, caused discomfort. Radiographs of spine (fig. 3) revealed a mild left dorsolumbar scoliosis with narrowing of the right half of the twelfth dorsal vertebra. There was thinning of the disks between eleventh and twelfth dorsal and twelfth and first lumbar vertebrae. A slight kyphosis was also present with anterior wedging of the eleventh and twelfth dorsal vertebrae. Some bony proliferation with partial bridging was present between these vertebrae. Radiographs of the pelvis (fig. 4) showed arthritic changes of the left hip with narrowing of the cartilage space, subchondral sclerosis (especially of the femur), irregularity of femoral articular cortex, and some slight marginal lipping.

The Widal test was negative in March 1939. (Dr. R. E. Crusan at Monrovia, Calif., reported the Widal was positive during the acute illness in 1934). Wassermann and tuberculin were negative. A Taylor back brace was applied and the patient continued working with some relief of back pain, but after a month she discarded the brace, and symptoms recurred. Some relief followed a leave of absence from work with rest, but her symptoms persisted. A spinal fusion of the Hibbs type with osteoperiosteal graft from tibia was performed January 12, 1940. Exposure of the articular facets between the lower two dorsal and first lumbar vertebrae revealed that the cartilage spaces were thinned. She made an uneventful recovery, and in July 1940, radiographs revealed a posterior bony fusion of the three involved vertebrae. In October 1940, she returned to secretarial work, and in December 1941 was still working and had had no recurrence of spinal pain.

Comment.—A diagnosis of typhoid spine was made in this case because of the history of typhoid fever, positive Widal, subsequent spinal symptoms and typical radiographic changes.

CASE III

History.—A white female, age 45 years, was seen at the hospital orthopedic clinic in March 1939. She had typhoid fever at age of 16, followed by weakness and pain in low back. Patient stated that she had always had pain and practically never was without it. Exertion and weather changes increased the pain which did not radiate into the legs, and she stated that spinal motions were limited.

Examination.—Physical examination revealed a well-nourished female with no visible spinal deformity, but with tenderness to percussion over the fourth and fifth lumbar vertebrae. Spinal motions in all directions limited due to pain and muscle spasm. Reflexes and sensations in lower extremities bilaterally present, equal, and normal. In addition to these findings she had hypertension, a large adenoma of the thyroid and nephritis. Widal tests for typhoid, paratyphoid A and B were negative as was the Wassermann. Radiographs (fig. 5) revealed a narrowing of the disk between the fourth and fifth lumbar

vertebrae, increased density and irregular outlines of the adjacent vertebral body borders and marginal lipping. She was fitted with a lumbosacral support. When seen several months later she was having less pain. Spinal fusion was contraindicated due to her severe hypertension and nephritis.

Comment.—This case was considered to be typhoid spine because of the history of typhoid fever which was followed by pain and weakness in low back with rather typical localized radiographic findings. In this case spinal symptoms persisted for over 29 years after the initial typhoid infection.

CASE IV

History.—A white female, age 13 years, was admitted to the hospital September 8, 1935, with an active typhoid fever and positive Widal test. She was discharged October 22, 1935. She was home in bed for 2 weeks, then became ambulatory. Soon thereafter she developed severe pain in her back, between the shoulder blades. She returned to the hospital December 24, 1935, because of pain in the back.

Examination.—Physical examination revealed no deformity, but dorsolumbar muscle spasm, limited back motions due to pain, and tenderness to percussion over mid-dorsal spine. Radiographs of the spine (fig. 6) showed a suggestive irregularity of the adjacent borders of seventh and eighth dorsal vertebrae, with possibly a slight narrowing of the disk between these vertebrae. Bed rest at home was advised. She returned to the clinic March 31, 1936, and still complained of pain in the mid-dorsal spine. There was also tenderness to percussion. Further radiographs were not made at that time and attempts to locate this patient for follow-up studies have been unsuccessful.

Comment.—Because of this patient's history of typhoid fever with positive Widal followed by persistent back pain and localized tenderness with suggestive radiographic changes, a diagnosis of typhoid spine was made.

SUMMARY

Four cases with spinal lesions diagnosed as typhoid spine are reported. This condition is not a frequent complication of typhoid fever for only 1 case was found in a review of a series of 410 cases of proven typhoid fever treated 3 to 11 years previously. However, the condition does occur and should be considered in a differential diagnosis of spinal lesions. Symptoms of typhoid spine, namely localized pain and limited spinal motions usually follow immediately after subsidence of the acute, febrile disease, and persists for months or years.

The physical findings are localized spinal tenderness, muscle spasm, and limited spinal motions. A mild scoliosis or kyphosis, although uncommon, may occur. The Widal test may be positive or negative. The radiographic findings are discussed.

Treatment of typhoid spine includes rest and immobilization with back brace, or cast, and for the more severe and otherwise uncomplicated cases, spinal fusion is indicated. Two cases of spinal fusion are discussed, both of which are completely relieved of their symptoms and are normally active.

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BLAST INJURY (CONCUSSION) OF THE LUNGS [1]

By Lieutenant Commander Joseph Palma, Medical Corps, United States Naval Reserve, and Lieutenant, junior grade, W. M. Enright, Medical Corps, United States Navy

Nineteen men presenting outstanding respiratory tract symptoms and no external evidence of injury were admitted to the United States Naval Hospital, Pearl Harbor, T. H., after the Japanese air raid attack on December 7, 1941. At first these cases were thought to be only smoke inhalation—(2549). Later, it became apparent that these men were suffering from a more serious form of pulmonary traumatism and that these effects were due to blast injury as described by various military observers in England and Europe. Of these 19, 12 were classified as mild, and discharged to duty, symptom-free, in 6 to 7 days; 3 were moderate, returning to duty in 10 to 14 days; 4 were severe. Three of this last group remained in the hospital and the fourth was discharged to duty on January 18, 1942, free of signs and symptoms, clinically and radiographically. The 4 severe cases are reported in detail.

CASE REPORTS

CASE I

Patient K was coughing violently on admission, December 7, 1941, and was in a moderately severe state of shock. He complained of pain in the chest, posteriorly. Respirations were rapid and labored, especially inspiration, and there was noticeable cyanosis. He was very restless and excited. Examination of the chest revealed diminished air entry and numerous moist and bubbling rales posteriorly. Anteriorly the rales were more sibilant in character. The temperature was normal. He was placed in an oxygen tent, continuous administration. Morphine sulfate, ¼ gr. was given frequently by hypodermic.

December 9, 1941.—Improved. Temperature normal. Signs clearing. Out of oxygen tent for short intervals. Cough well controlled with codeine.

December 11, 1941.—Improved. Temperature normal. Signs clearing. Out of oxygen tent for longer periods. Cough well controlled with codeine.

December 13, 1941.—No signs or symptoms. Convalescing.

[1] Received for publication March 9, 1942.

December 20, 1941.—Signs and symptoms of bronchopneumonia developed; temperature spiking to 104° F. This complication was rapidly controlled with sulfadiazine.

December 23, 1941.—Temperature normal but great respiratory distress persisted in spite of the normal temperature. His respirations were very shallow with an inspiratory grunt. There was hemoptysis, cough, cyanosis, and marked restlessness and apprehension. The x-ray showed a pronounced disseminated mottling of both lung fields with a picture simulating hematogenous tuberculosis (fig. 1).

December 24, 1941.—Seventeen days after admission, the patient continued to be gravely ill with extreme dyspnea, even though he was continuously in an oxygen tent. Blood count revealed 4,800,000 red blood cells per cubic millimeter with 14 gm. of hemoglobin, 30,500 white blood cells per cubic millimeter, of which 8 percent were band and 87 percent segmented polymorphonuclear leukocytes, 2 percent lymphocytes and 3 percent monocytes. The sulfadiazine level was 5.8 mg. per hundred cubic centimeters. Signs of bronchopneumonia persisted.

December 25, 1941.—There was a leukocytosis of 14,800 with 75 percent polymorphonuclar neutrophiles. The sputum was negative for acid-fast bacilli. The patient continued to be acutely ill with marked cough, hemoptysis, pain in the chest and very limited respiratory excursions. There was bilateral dullness of the chest with numerous coarse to crepitant râles.

December 29, 1941.—All signs and symptoms still present. The sulfadiazine level was 11.5 mg. per hundred cubic centimeters. Sulfadiazine was discontinued. An electrocardiogram showed right axis deviation. Potassium iodide was given as a prophylaxis against lung fibrosis. Atropine and aminophylline were administered to dry up bronchial secretions and to relieve bronchospasm. There were 11,500 leukocytes per cubic millimeter.

January 1, 1942.—The patient was still in the oxygen tent and suffering acute respiratory distress in spite of normal temperature. Both lungs were filled with bubbling râles and marked bilateral dullness was demonstrated. X-ray showed extensive mottling of both lung fields.

January 3, 1942.—The patient improved remarkably and could remain out of the oxygen tent for periods of 20 minutes duration. Cough was still prominent but diminishing. His appetite improved and he was much more alert.

January 4, 1942.—The patient could remain out of the oxygen tent for 2½ hours and the râles in his chest were less prominent. By January seventh he could breathe much more freely with less coughing. The oxygen was no longer necessary. His temperature was normal and chest signs had abated. X-ray of his chest showed a persistence of the extensive mottling.

January 21, 1942.—He continued to improve and was up in a wheel chair. Six weeks after injury an x-ray film of the chest (fig. 2) showed very little change although the patient was clinically improving daily.

CASE II

The second patient, M, developed progressive respiratory difficulty after exposure to blast and smoke. He was in moderate shock, cyanosed, coughing and restless, and his chest excursion was very limited. He was coughing up considerable blood-tinged sputum. His chest was hyperresonant and there were disseminated râles crepitant to coarse. His temperature soon rose to 102° F. and oxygen was necessary to control respiratory distress. The x-ray film revealed a light ground glass appearance throughout both lung fields which was reported as a "bronchiolitis."
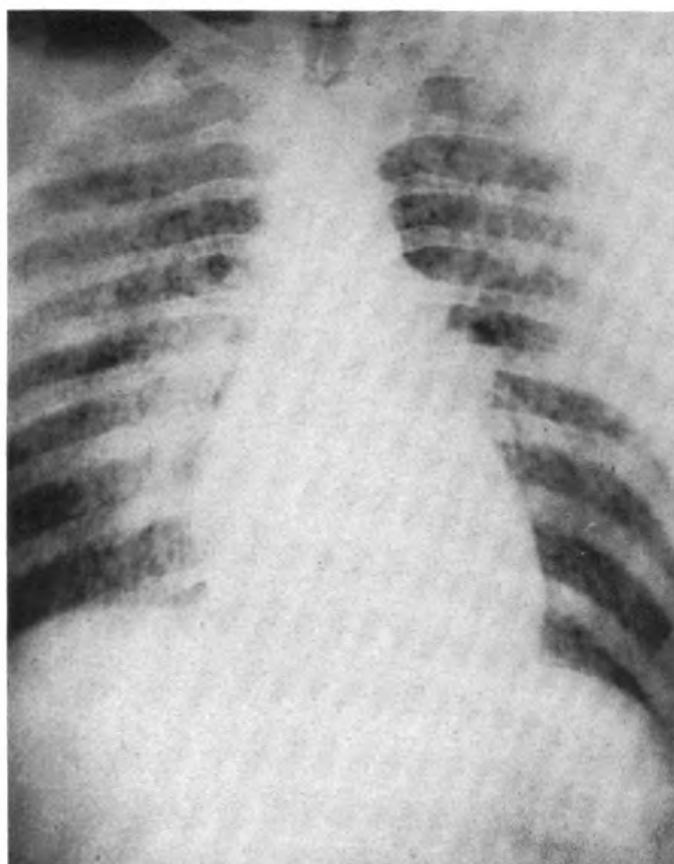
FIGURE 1 (CASE 1).—SHOWING MOTTLING OF BOTH LUNGS.
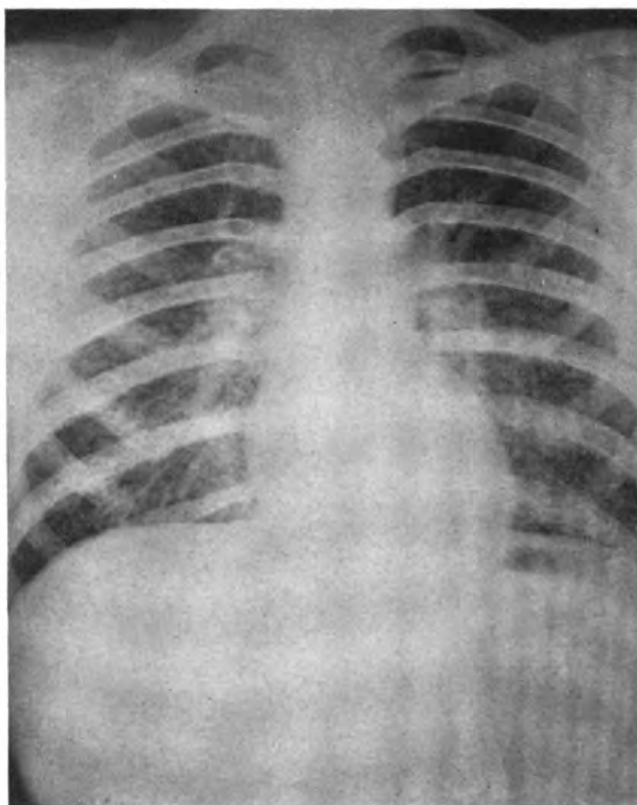
FIGURE 2 (CASE 1).—SHOWING CHEST 6 WEEKS AFTER INJURY.

PLATE 34
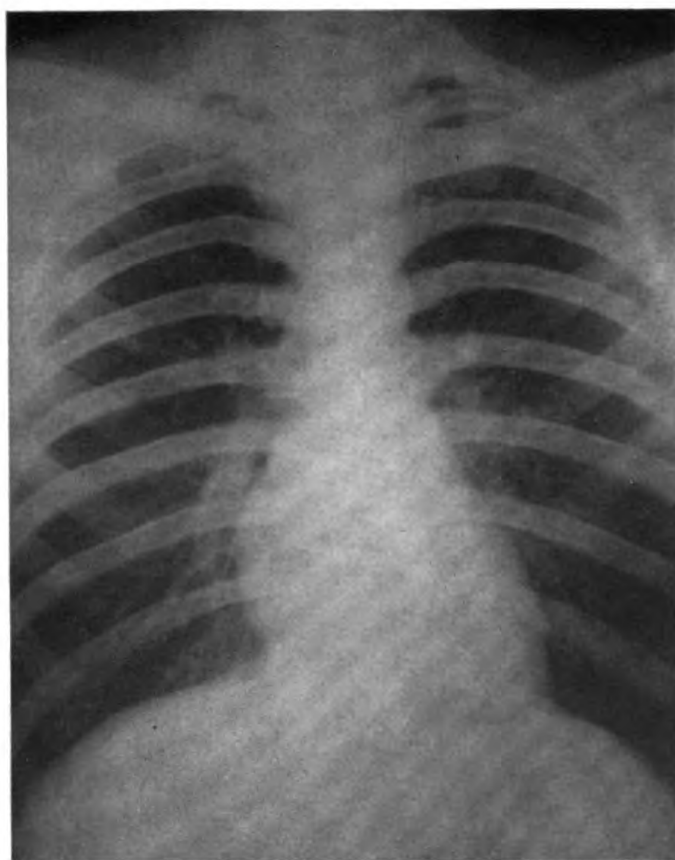
FIGURE 3 (CASE 4).—SHOWING DENSE MOTTLING OF LUNG ON ADMITTANCE.
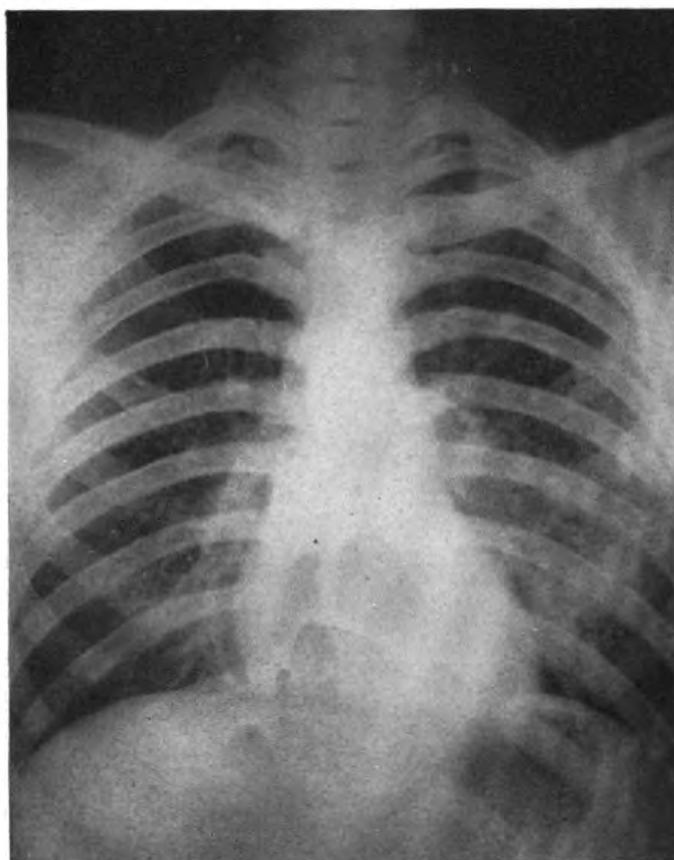
FIGURE 4 (CASE 3).—LUNGS 2 WEEKS AFTER ADMITTANCE.

He was started on sulfadiazine, which did not control the fever. Morphine sulfate ¼ gr. was given frequently by hypodermic.

December 14, 1942.—The patient was in acute respiratory distress with shallow rapid respirations not well controlled even with oxygen. He had numerous, severe coughing spells which responded fairly well to codeine. He was raising a large amount of grayish, frothy sputum which on occasions was bloody. A blood count showed 4,150,000 red blood cells and 8,750 white blood cells per cubic millimeter, of which 78 percent were polymorphonuclear neutrophiles.

December 28, 1941.—All the signs and symptoms, mentioned before, persisted. There were 12,400 white blood cells per cubic millimeter, of which 70 percent were neutrophiles. The sulfadiazine level was 9.3 mg. per hundred cubic centimeters. Urinalysis was negative. The sputum was negative for acid fast bacilli.

January 1, 1942.—The patient was still acutely ill with all signs and symptoms still present. The sulfadiazine level was 14.4 mg. per hundred cubic centimeters. Repeated sputum specimens revealed no acid fast bacilli. X-ray showed intense bilateral mottling of the lung fields.

January 4, 1942.—The patient was breathing much more freely, and his temperature had become normal. Both objective and subjective signs of acute pneumonic pathology had diminished in spite of x-ray evidence which showed no diminution of the lung process. Sulfadiazine was discontinued.

January 10, 1942.—The patient continued to improve and was up in a wheel chair for periods of 1 hour.

January 21, 1942.—Six weeks after injury an x-ray film of the chest showed very little change, although the patient was clinically improving daily.

CASE III

The third patient, G, showed the same signs and symptoms on admission as the two preceding cases. Many sibilant râles were present on both sides of the chest and the x-ray showed intense mottling of the entire right lung. He soon developed additional signs and symptoms of bronchopneumonia. His temperature was 100° F. The white blood count showed 10,600 white blood cells per cubic millimeter, of which 71 percent were neutrophiles. He was started on sulfathiazole.

December 15, 1941.—The patient continued to be acutely ill, with marked respiratory distress. The sputum was negative for acid fast bacilli. The Kahn and urinalysis were negative.

December 18, 1941.—The patient was subjectively much improved. Physical signs in the chest showed a clearing of the pathologic process. X-ray demonstrated involution of the pneumonia. The white blood count was 7,400 per cubic millimeter and the hemoglobin was 13 grams per hundred cubic centimeters.

December 30, 1941.—The sedimentation rate at this time was 17 mm. in one hour. The x-ray showed complete resolution of the pneumonic process. The symptoms of acute illness had disappeared and the patient was up in a wheel chair. He became ambulatory on January 3, 1942, and has gradually improved up to the present, although he still complains of slight pain to the right and left of the sternum.

CASE IV

The fourth patient, L, was admitted with the symptoms of severe shock, marked dyspnea and some cyanosis. Cough was spasmodic and intractable. The restlessness and excitement was so extreme that he was almost manic. There were many bubbling and sibilant râles bilaterally both front and back.

Oxygen was necessary to control the dyspnea and cyanosis. Morphine sulfate ¼ gr. hypodermically and codeine 1 gr. orally were administered to alleviate the marked restlessness and cough.

December 11, 1941.—No change in signs or symptoms. He was raising considerable frothy blood-tinged sputum. X-ray showed dense mottling of the lower two-thirds of the left lung and slight mottling on the right (fig. 8).

December 18, 1941.—Restlessness, cough and respiratory distress gradually diminished during the past week. Oxygen was still needed for periods of 2 to 3 hours several times a day.

December 29, 1941.—Improvement continued. No signs or symptoms. X-ray showed the lung lesions completely resolved (fig. 4).

The patient was up and about on January 4, 1942, comparatively asymptomatic, but three days later complained of severe abdominal pain. This pain subsided, he gradually improved, and was discharged to duty on January 18.

DISCUSSION

At first we considered these cases as suffering only from the irritating effects of the inhaled smoke or gas on the mucous membranes of the bronchial tree. Later, when seven cases failed to get well within a few days and, in addition, developed signs and symptoms of bilateral bronchopneumonia, this concept was broadened to include the factor of secondary pulmonary infection.

However, this theory did not satisfactorily explain the relapse, signs and symptoms and roentgenographic evidence in cases 1 and 2 who were behaving more like cases of lipoid pneumonia than any other condition with which we were acquainted. The clinical picture presented by the 19 men impressed all observers. There were, in different combinations and varying degrees of severity, shock, chest pain, cough, cyanosis, restlessness, and dyspnea. The restlessness was difficult to control with the usual hypnotics. The dyspnea was particularly inspiratory, and diminution of breath sounds, especially posteriorly, was a constant result from plugging of the bronchioles by cellular elements, fibrin, blood, or a combination of them. The sputum was frequently blood-streaked and frothy or similar to the "prune juice" of the red hepatization stage of lobar pneumonia.

More leisurely study of the serious cases and a perusal of the literature on pulmonary injury brought us to the conclusion that we were dealing with the condition described by the British as blast injury of the lungs. The outstanding lesion of this condition is pulmonary hemorrhage resulting from the impact on the body wall of the positive pressure wave created by the detonation of high explosive. Histologically, there is rupture of the capillaries and alveolar walls and the air sacs are filled with red blood cells. Subarachnoid hemorrhage is produced also, in some cases, by the tremendous pressure developed on the venous side from the sudden compression of the thoracic cage. Clinically, there is gross shock, out of proportion to the degree of

injury, pain in the chest, dyspnea, cough and cyanosis. Restlessness is a prominent symptom and may be extreme. It is thought to be a result of the central nervous system lesion. The sputum is frequently blood-stained and free hemoptysis may be present. Physical signs vary greatly but poor respiratory excursion, diminished air intake, and coarse or sibilant râles are the normal findings on examination of the chest. X-ray films reveal the characteristic, poorly demarcated areas of increased density (mottling) scattered throughout both lung fields, resembling in some measure a patchy pneumonic consolidation. Secondary infection is not uncommon and pneumonia is not an infrequent complication. The severity of the injury produced, and, therefore, of the signs and symptoms exhibited, is directly proportional to the distance between the patient and the detonation of the high explosive.

All of the men in our series of cases had been in the vicinity of explosive blasts and most of them, for a considerable period of time, had inhaled quantities of smoke. Knowing the post of duty manned by each individual during the air raid, these facts were established, in part, by direct questioning of the men and by deduction.

Further inquiry among the medical officers attached to the hospital revealed two facts: First, that 15 to 20 casualties found dead on arrival, December 7, 1941, had presented no external evidence of injury other than bloody froth about the lips and mouth, with in some cases a noticeable admixture of oil; and second, that 6 to 8 casualties who died within a few hours after admission had no external evidence of injury. These officers added that they considered the marked restlessness exhibited by these patients as due to the apprehension that may be expected to accompany inspiratory difficulty plus some degree of psychic trauma. No autopsies were performed on these cases because of the really tremendous pressure of work created by the imperative needs of the living.

This factor of tremendous pressure of work resulting from and carried on during the air raid, and continuing for days afterward, was a unique experience and, therefore, very difficult to describe. It is mentioned here merely in extenuation of the sketchiness of the histories and case reports and, also, of the time lag before the true nature of these cases was recognized. However, there was no such lag in the application of effective treatment.

Shock was controlled by the free oral administration of fluids (which were eagerly taken), heat, and rest. In retrospect, plasma infusions would have helped at least three of these men. Morphine in the usual doses was given frequently, as restlessness, in even the mild cases, was not well controlled by the barbiturates, and it appeared to be the drug of choice in the light of this experience. Cough re-

sponded to the administration of codeine in doses of 1 grain two to three times daily. Pain was alleviated by either the morphine or codeine as given for the relief of the symptoms just mentioned. Dyspnea and cyanosis were in most cases relieved by oxygen administered either continuously in a tent or intermittently by the B. L. B. mask. In fact, several of these cases would have died without oxygen because there was so little air-containing lung left.

High explosive blast injuries to the lungs are due to the impact of the positive pressure wave on the body wall of the chest and abdomen. This positive pressure wave is a longitudinal, excessively intense sound wave, and its behavior and often freakish effects can best be interpreted on the basis of the physics of wave motion. Sound waves of the pitch that predominates in bomb explosions may be as long as 30 feet and the amplitude may be considerable, for in the compression part of the wave pressures up to 200 atmospheres, 1⅓ tons per square inch have been observed. The possibilities: One, that these lesions are due to the lowering of alveolar pressure by the suction wave, acting through the respiratory passages, with consequent rupture of the alveolar capillaries; or, two, that they are caused by distention of the lungs with air, have now been discarded. Zuckerman's brilliant experiments on laboratory animals (2) proved this point, which had been the view of Hooker, who wrote with reference to his experiments on frogs:

It is wholly improbable that lowered pressure could distend these organs sufficiently to cause their rupture. On the other hand a sudden elevation of pressure, retarding the expulsion of air through the trachea and forcibly compressing the body walls, could readily rupture these delicate organs.

The same belief was stated by Kretzschmar in his clinical description of blast casualties in Spain. Recently King and Curtis (6) published an excellent review of the literature summarizing the nature, effects and treatment of lung injury due to detonation of high explosive. They emphasize the importance of early recognition of this injury and the value of rest and oxygen therapy. Further emphasis should be placed on the degree of restlessness and shock exhibited by these patients, which is out of proportion to the apparent severity of the injury. Other articles on this subject by G. Hadfield (3) (4) and associates, and especially the monograph of O'Reilly and Gloyne (5), describe a series of cases of men suffering from blast injuries to the lung of varying severity in which the "circumstances of the injury comply with the criteria set up by Zuckerman in his experimental work as nearly as is likely to be in human cases." Our series, likewise, complies with these criteria, and it is felt that the added feature of smoke or gas inhalation altered only slightly the primary injury resulting from the concussion. Other than the possibility of bomb

fragments, there were no flying missiles or falling debris to cause crushing injuries to the body wall. Lack of autopsy material prevented proof of pulmonary hemorrhage and rupture of elastic tissue and capillaries in the most affected parts in our cases. However, the history and symptoms, physical signs, roentgenographic evidence, and clinical course of these cases present a picture so strikingly similar to the one described by British authors that we feel justified in presenting them as cases of blast injury.

ADDENDUM

An additional case of blast injury has been observed, the details of which, as to time and place, cannot be disclosed. However, this man was in the immediate vicinity of high explosive blast and he remembers inhaling an acrid-smelling smoke for a moment or two after the blast. During the next 12 hours, there were no symptoms except slight nausea. Then he noted some pain in his chest and shortness of breath on slight exertion which increased in severity over an 8-hour period. At this point, 20 hours after the injury, he was admitted to the hospital in a state of moderate shock, extremely restless, with shallow, rapid and painful respirations. He was moderately cyanotic and there was some cough. The temperature was 100.6° F.; the pulse rate, 110 per minute; and the respirations, 38 per minute. The examination of the chest revealed only a few scattered rales. There was no external evidence of injury. The x-ray of the lungs showed "many varying-sized but relatively small and poorly demarcated areas of increased density scattered throughout both lung fields." There was "some confluency of these shadows, particularly in the region of the right middle lobe." The pulmonary findings were said to be "compatible with the after-results of a blast injury (multiple pulmonary hemorrhage)."

He was immediately placed in an oxygen tent; fluids were given freely, and morphine sulfate, ¼ gr. hypodermically, was given as needed for the relief of pain and restlessness.

The next day he was worse in spite of therapy. The temperature was normal, the pulse 100, and the respirations had increased to 50 per minute. On the second and third days there was little change in his condition, clinically or radiographically.

Improvement began on the fourth day and continued rapidly. He raised a quantity of muco-purulent frothy sputum. On the fifth day he was removed from the oxygen tent, although the rate of respirations was 32 per minute. Clinically he was much improved; x-ray, however, showed little change. His future course will be watched with interest.

COMMENT

It is suggested that the diagnosis of Blast Injury (concussion) of the lungs be included in the *Diagnosis Nomenclature of the U. S. Navy.* Although these 19 men were given a diagnosis of smoke inhalation (2549), the diagnosis could also have been, in view of the pathology of the condition, compression (2511); hemorrhage, traumatic (2541); or rupture, traumatic (2548).

Further, it is urged that medical officers of the military forces and of the civilian medical defense units conducting first-aid stations keep

this condition in mind, since rest and early application of proper thera-
peutic measures is of prime importance.

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VACCINIA OF THE EYELIDS [1]

By Lieutenant Commander William L. Berkley, Medical Corps, United States Navy

Accidental ocular vaccinia is not a rare condition. The purpose
of this paper is to reemphasize its possibility, to give additional case
reports, and to offer suggestions for its prevention and treatment.

Atkinson and Scullard (1), and Pfingst (2), have recently re-
ported cases of this condition with appended bibliographies which
contain many excellent references to the literature on the subject.

The condition may result from either auto-inoculation or hetero-
inoculation. In the latter case the condition is most often seen fol-
lowing secondary contamination of the eye with vaccine transferred
from the site of the intended inoculation or from infected material
from other persons. The possibility and severity of auto-inoculation
obviously rapidly diminishes as the immunity from the primary
vaccinia progresses. However the second condition may find the
individual with no established immunity and hence present very
severe and serious ocular complications.

The diagnosis should present little difficulty provided the possibil-
ity is kept in mind. But no doubt the complicated picture which
the condition presents in its later stages causes many cases to be
incorrectly diagnosed.

The prognosis, however, is generally good considering the severity
of the clinical picture. But the cornea may be involved in as high
as 10 percent of cases, and rarely the condition may lead to sym-
blepharon, ankyloblepharon, entropion, or corneal damage of suffi-
cient severity to cause complete loss of vision in the affected eye.

Once the condition has developed, the treatment and management are directed primarily toward preventing corneal ulcerations or limiting the damage if the cornea has already become involved.

Such treatment should generally include bed rest in severe cases, thorough irrigations with warm boric acid solution, sufficient in time and interval to maintain satisfactory ocular hygiene, satisfactory cycloplegia usually with 1 percent atropine sulfate, cold compresses to the lids in cases of excessive edema, and frequent but careful and gentle inspections of the cornea for evidence of early abrasions or ulcerations.

In addition to these measures we believe sulfonamide therapy has definite value as a further safeguard against corneal involvement. Baily and Saskin (3) found the drug very beneficial in six cases of corneal ulcers mostly of chemical and traumatic origin. We have used these drugs in many types of specific and nonspecific corneal ulcers, and the results have been strikingly beneficial in practically all cases encountered except those involving tuberculosis, leprosy, and scleritis. As opposing this view, however, Atkinson and Scullard (1) in a paper, which contains very interesting and rational suggestions on the treatment of this condition, concluded, after satisfactory experiments on rabbits, that the action of the virus was not inhibited by sulfanilamide, neoprontosil, or sulfapyridine. Since, however, the cornea of the rabbit is apparently resistant to the vaccinia virus no absolute conclusions can be drawn from this work on the effectiveness of the sulfa drugs in actual or threatened corneal damage resulting from vaccinia in the human eye.

Because of the strikingly beneficial effect obtained in so many other types of corneal ulcers the continued prophylactic use of the sulfonamides in this serious condition would seem justified until sufficient observations have proved the contrary.

As a prophylaxis against these corneal ulcers we believe sulfanilamide is the sulfa drug of choice. Small doses for ocular therapy seem to be as effective as the larger ones and cause fewer side reactions. Two-thirds to one gram orally four times per day will maintain a satisfactory aqueous concentration in most indicated eye conditions. For local application a 5 percent sodium sulfathiazole ointment in a water soluble base is recommended. This may be placed in a small ophthalmic ointment tube for convenience. Such an ointment tends to have little keratolytic effect on the cornea, suppresses the bacterial flora in the cul-de-sac, keeps the affected field clean, and prevents sticking of the ulcerated lid margins.

CASE REPORTS

Case 1.—Mrs. J. R., age 29, whose general health had always been good, consulted us because of a small lesion on the left upper eyelid. She first

noticed the lesion 5 days before as a small red itching area which subsequently developed into a vesicle. On examination a typical umbilicated cowpox lesion about ½ cm. in diameter on a red swollen base was seen on the left upper lid medially and just above the lash margin. The entire lid was red, edematous and ptosed, and there was a painful adenopathy involving the corresponding preauricular, anterior cervical, and submaxillary lymph glands. The eyes were otherwise essentially normal. The appearance of the lesion immediately suggested its nature, but the patient denied any recent inoculation and showed an old vaccination scar on the arm. Further questioning, however, revealed that her year-old baby had been inoculated 2 weeks before with a resulting severe vaccinia. She had actively cared for the child but did not recall that it had at any time scratched her lid. However some type of accidental inoculation from this source was considered the most probable explanation for her vaccinia.

The case was treated as above outlined and the cornea was carefully inspected daily for evidence of abrasion. During the 3 days following the first visit the lesion progressively extended to involve the lid margins, and a kissing ulcer developed on the lower lid. Lid edema completely closed the eye and chemosis of the conjunctiva developed. The cornea however remained intact and the condition subsided in the usual manner without corneal involvement or other permanent ocular damage. This was a case of hetero-inoculation in which the reaction was probably lessened because of partial immunity from a previous vaccination.

Case 2.—J. H. S. A white boy, age 6, was brought to the out-patient department of the hospital for treatment of swollen right eyelids of 2 days' duration. Examination revealed considerable redness and swelling of both upper and lower lids of the affected eye and several discrete "kissing" vesicles on an inflammatory base involving both lid margins. There was an associated painful regional adenopathy involving the preauricular and submaxillary lymph glands (figure 1).

Both bulbar and palpebral conjunctivae were injected, but smears showed no incriminating organisms. Vision was normal in each eye, and the cornea of the affected eye was intact. The nature of the lesion was immediately suspected. Questioning revealed that the patient had received cowpox inoculation 6 days before, and a developing primary vaccinia was present on the left arm. A diagnosis of accidental vaccinia was made and treatment as above outlined was instituted. Additional lesions later developed in the vestibule of the right nostril and on the left upper lid, but immunity had sufficiently developed by this time to prevent these reaching an advanced stage. Due to excessive edema, cleansing and corneal inspection became increasingly difficult, but the cornea remained intact. The denuded lid margins were frequently separated and kept clean with sodium sulfathiazole ointment. After the tenth day all vaccinia lesions began to subside and complete recovery followed except for slight lid scarring and the loss of some lashes. This case apparently was one in which the patient received the intended and accidental inoculations at the same time. Because of no initial immunity the reaction was severe.

Case 3.—S. E. L. A white baby girl, age 18 months, was brought to the hospital out-patient department for treatment of an inflamed right eye. The patient had received a cowpox inoculation 14 days before, and showed a subsiding vaccinia on the lateral aspect of the left thigh. The reaction had reached its height on the tenth day. The mother first noticed a vesicle on a red base on the medial aspect of the right upper lid margin on the eleventh day.

The lesion had enlarged during the past 3 days. Examination at the clinic showed a small pustule on the marginal surface of the right upper lid close
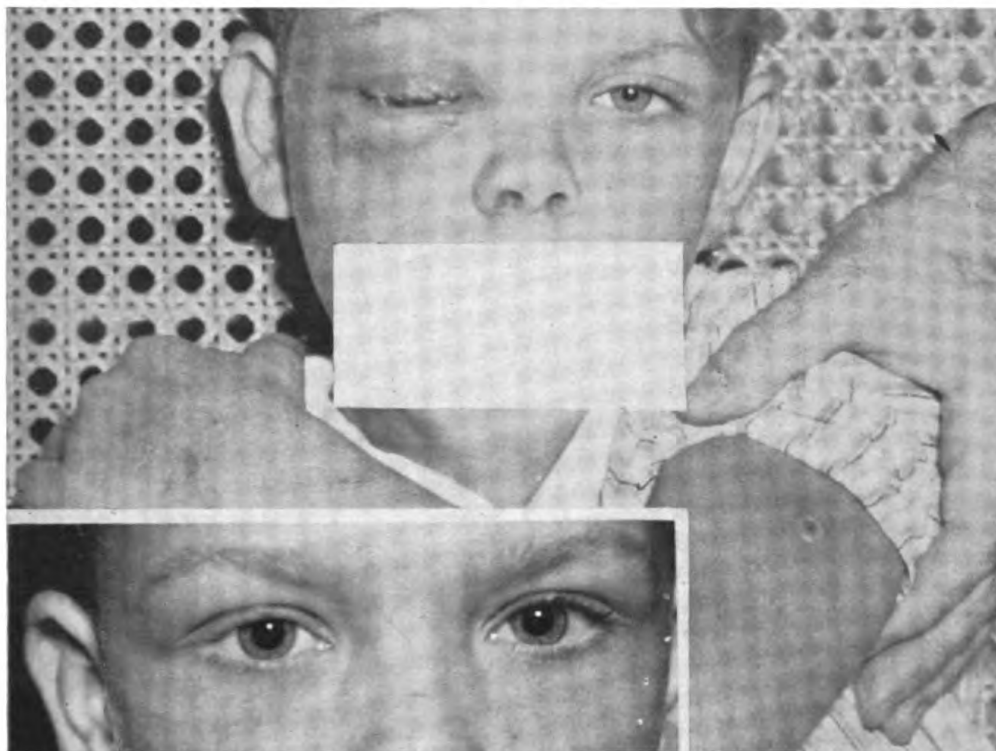
FIGURE 1.—SHOWING EARLY VACCINIA OF LEFT ARM WITH SIMULTANEOUS SEC-
ONDARY INOCULATION OF RIGHT EYELIDS AND RIGHT NOSTRIL. REACTION
WAS SEVERE. INSERT SHOWS RECOVERY COMPLETE EXCEPT FOR SLIGHT
SCARRING AND LOSS OF SOME LASHES OF RIGHT UPPER LID.
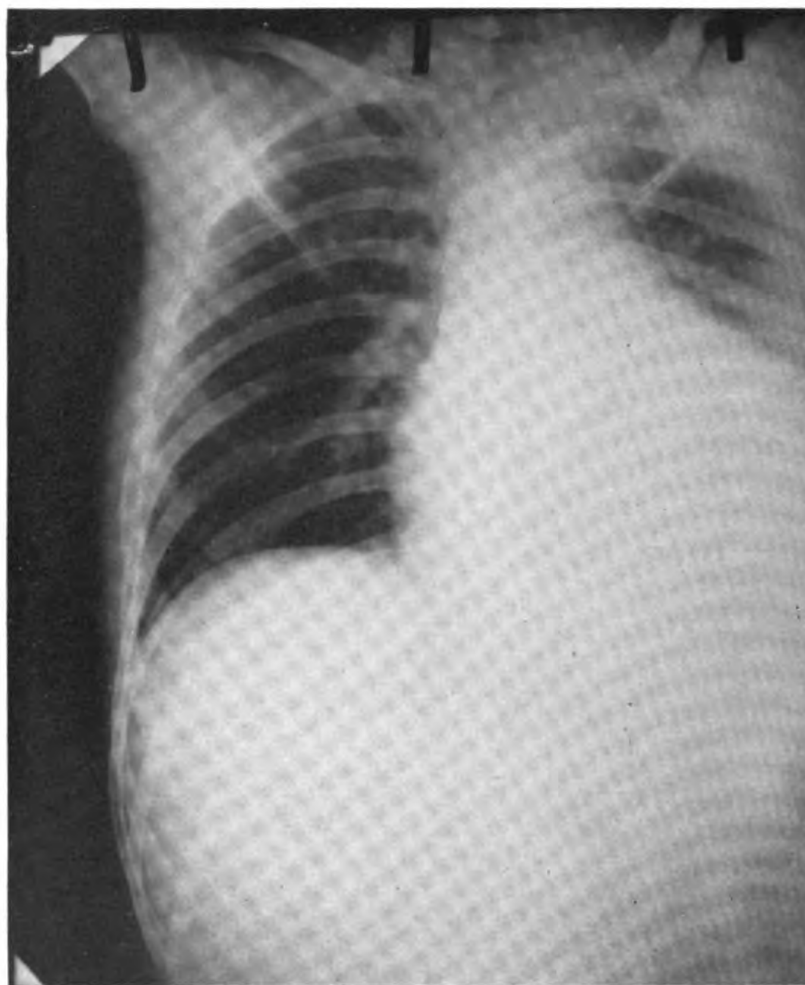
FIGURE 1.—SHOWING PERICARDIAL EFFUSION AT THE TIME OF ADMISSION.
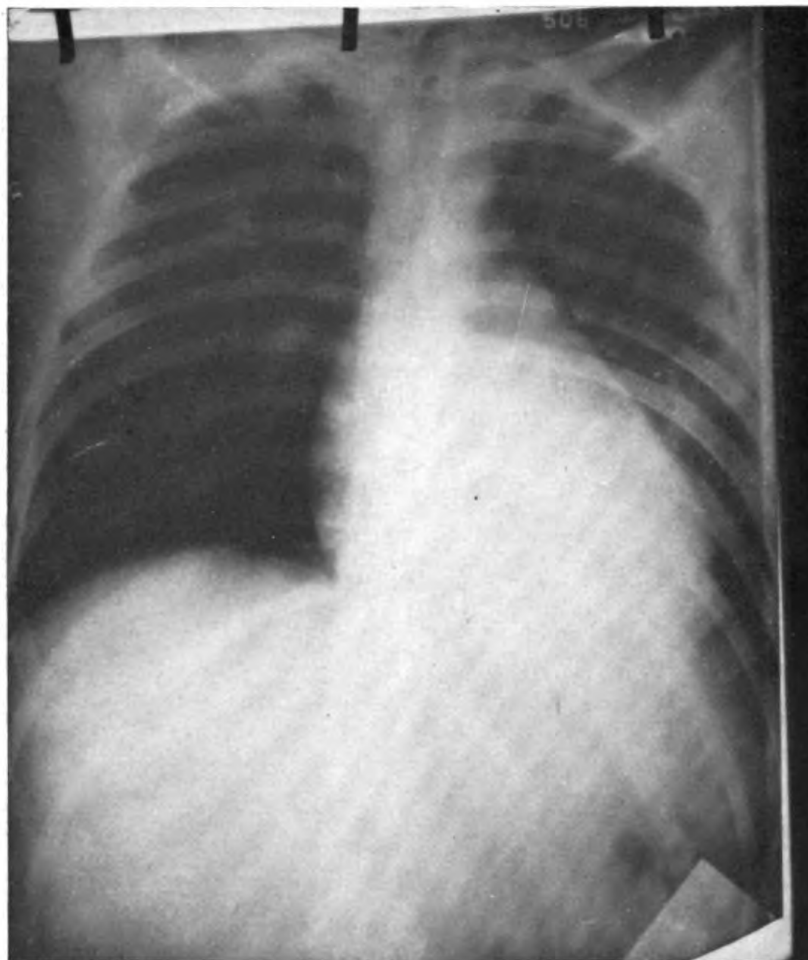
FIGURE 2.—CONDITION OF HEART AFTER 3 DOSES OF EPHEDRINE HYDROCHLORIDE.

FIGURE 3.—CONDITION OF HEART ABOUT 1 MONTH LATER.

to the inner canthus. The affected lid was red, and moderately swollen. The bulbar conjunctiva was injected and the cul-de-sac contained some purulent exudate. Smears showed no incriminating organisms. There was moderate preauricular adenitis on the right side. The vaccinia on the left leg had been covered with a shield for the past 2 days. A diagnosis of accidental vaccinia of the lid was made.

This infection was obviously acquired by auto-inoculation but because of the advanced stage of the patient's acquired immunity at the time of the accidental inoculation the reaction was not severe and quickly cleared under mild treatment including gentle irrigations and sodium sulfathiazole ointment locally.

COMMENTS

Responsibility for preventing these complications rests largely upon those doing the vaccinations. With proper care and comprehensive instructions to the patient or his responsible guardian the number of such mishaps can be greatly diminished.

To accomplish this the following recommendations are made:

1. Use a minimum amount of vaccine for each inoculation. With the multiple pressure method now generally in use, a minute amount of vaccine is sufficient. The excess rapidly dries and the possibility of accidental inoculation from this source is thereby diminished.

2. In small children, immediately protect the vaccination site from manual manipulation. This may be done, for example, on the arm by the simple expedient of having the patient wear a long-sleeved garment.

3. Carefully instruct adults and responsible guardians, in the case of small children, concerning the nature of these accidents, their danger, and the methods of preventing them.

SUMMARY

1. Three assorted cases of vaccinia of the eyelids are presented.

2. Treatment including sulfonamide therapy as a possible aid against corneal involvement is discussed.

3. Suggestions for diminishing the number of such accidents are offered.

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TREATMENT OF PERICARDIAL EFFUSION WITH EPHEDRINE [1]

By Lieutenant Commander Earl B. Erskine, Medical Corps, United States Navy, retired

The following case is offered as a suggestion in the treatment of pericardial effusion with the hope that an evaluation of the usefulness of ephedrine may be made by other observers.

History.—A white male, age 19 years, was admitted March 23, 1942, complaining of painful and swollen knee joints, ankle joints, right wrist joint, and both shoulder joints. Two weeks before admission, he had moderate pharyngitis.

Physical examination.—On admission, the temperature was 101° F.; pulse, 98; respiration, 20. Oropharynx: Tonsils embedded; exudate expressed from both, but more noticeable from the left. Submaxillary nodes palpable and tender. Blood pressure 118/76. Heart normal in size and position; shows normal sounds. Electrocardiograph shows ventricular rate of 104 per minute; PR interval .16 second, normal rhythm and essentially normal myocardium.

Laboratory report.—Urinalysis normal. R. B. C. 4,100,000. W. B. C.: 20,300. Differential: Metamyelocytes, 8 percent; segmented neutrophiles, 66 percent; lymphocytes, 22 percent; monocytes, 4 percent. Sedimentation rate 23 mm. per hour.

Clinical course.—Routine treatment instituted. Subsequent temperature curve for 4 days showed an afternoon rise to 103.4° F., and remissions to 100.8° F., with sweating and continuous joint pain, swelling and redness as described above. Two days after admission there was evidence of pericarditis: the patient complained of precordial pain and dyspnea. The heart was not enlarged to percussion. On auscultation an inconstant friction rub was heard over the precordium, particularly apparent at the third left costosternal junction, and there was a soft systolic murmur at the apex which subsequently disappeared.

During the succeeding 4 days there was a diminution in pyrexia to a high level of 101.4° F., and friction rub persisted. On the 4th of April, 12 days after admission, Ewart's and Rotch's signs were present and a portable x-ray further supported the opinion that effusion had occurred (fig. 1). Orthopnea was present; pulse was feeble and rapid; blood pressure 100/60. Electrocardiogram showed sinus tachycardia and low voltage in all leads. There was an increase in the temperature curve to a daily high of 102.8°F., with remissions to 100.4° F.

After the effusion had existed for 2 days ephedrine hydrochloride ⅜ gr. was given by mouth every 4 hours for three times. The following morning Rotch's and Ewart's signs had disappeared and the friction rub recurred with intensity as when first observed. X-ray film (fig. 2) showed a marked retreat of cardiac borders. Blood pressure, 130/76. Sodium salicylate in 3 gram amounts was given twice daily by rectum.

Four days following the administration of ephedrine, the temperature and pulse curve receded to normal by lysis. The heart borders were normal to percussion and an x-ray film taken May 10 (fig. 3) showed a normal contour, size, and position of the heart. Sounds were normal.

Graduated exercise showed a moderately low cardiac reserve in the past 2 weeks, but electrocardiograph evidence showed no abnormality.

The patient is being retained for tonsillectomy. He has lost 22 pounds from his admission weight. There are no physical signs of pericardial, myocardial, or endocardial residuals. Laboratory check shows RBC: 4,000,000; WBC: 6,150; normal differential. Sedimentation rate, 6 mm. per hour.

The rationale of giving ephedrine hydrochloride was predicated on the theory that pericardial effusion on a rheumatic basis is an allergic

phenomenon. The prompt response is believed to be more than coincidental because there was definite subsidence of the effusion within 12 hours following the last dose of ephedrine. The tamponade effect evidenced in orthopnea and lowered blood pressure was apparently relieved as promptly.

It is believed that considering the essential risks incident to paracentesis, similar drug therapy should be used early in cases of simple effusion of rheumatic pericarditis. Undesirable effect as peripheral vasoconstriction appears to have been outweighed by the rapidity with which ephedrine apparently reduced the effusion.

MEDICAL AND SURGICAL DEVICES

A SIMPLE DEVICE FOR TEMPORARY SUPPORT OF FRACTURED MANDIBLE [1]

By Lieutenant, junior grade, R. W. Rommel, Medical Corps, United States Naval Reserve

As is generally known, facilities for management of fracture of the mandible aboard our small ships are of necessity very limited inasmuch as these are usually considered problems for the dentist.

The following describes a device used in the treatment of such a case which occurred aboard a destroyer while under way. The materials needed are a sailor's white hat, rubber gloves, rubber bands, adhesive tape, match sticks, and a spool of coarse thread.

The rim is removed from a sailor's white hat, and four horizontal slits, about ½ inch long, are made, clockwise, at 8, 4, 11, and 1, one-half inch from the edge of the crown. Four 3- by ½-inch strips of adhesive tape are passed through the slits and around matchsticks, then doubled back over each other, and secured by cotton ligature. The cuff is cut from a rubber glove; this circular tube is then cut crosswise, leaving a rectangular sheet of rubber, with a welt edge. The corners are reinforced with adhesive tape, and a small hole is cut in the middle of each reinforcement to admit a rubber band, through the loop of which a matchstick is placed. The rectangular sheet, with four rubber bands attached, is placed beneath the jaw, welt edge outward; the opposite loops of rubber bands are placed around matchsticks on hat crown. Tension can be adjusted, at will, by taking up on rubber bands (fig. 1).

This device increased the patient's comfort immediately after application. During its use, the position of fragments was considerably improved. I believe the small amount of mobility tended to jockey the fragments into proper position. Incidentally, an ice bag may be used effectively to reduce swelling without interfering in any way with the device. The patient was transferred after 6 days for further disposition. Diagnosis was confirmed by roentgenogram.

[1] Received for publication March 23, 1942.

A NEW TYPE CRASH KIT FOR AIR STATIONS AND FOR GENERAL EMERGENCY USE [1]

By Lieutenant Joseph C. Baier, Medical Corps, United States Naval Reserve

The experience gained at a Marine Corps air station in the use of our present crash kits during several emergencies having proved their inadequacy an attempt to improve upon them seemed justified. A second factor entered the picture when plasma kits were made available, as these kits required more space than our canvas bags allowed. Also, the administration of plasma at the scene of a crash demanded more antiseptics and more sterile materials than our present first-aid kits supplied. As is commonly true air crashes have a habit of occurring in difficult terrain and at odd times of the day. Wet ground, brushy country and poor lighting have all added to our problems at times and a kit which must be emptied out on the ground to make its contents available is anything but satisfactory. The new kit, as designed, was intended primarily to facilitate the transportation and administration of plasma in the field, but in the course of its evolution an attempt has been made to incorporate into its features all additional attributes of a first class aid kit which would cover any anticipated needs at the scene of an air crash. Its ability to meet all these needs should presuppose its usefulness as a general emergency aid kit.

The inventory of the kit was gradually developed by inviting suggestions from all members of the medical staff of the air station and then eliminating overlapping articles. By so doing, it has been possible to arrive at a list which suits our needs in repair shops, crash boats, and hangars as well as for air crashes. There is, of course, no reason why the contents should not be varied to meet the needs of other types of shore and field activities than that of air stations.

The following considerations, in order, governed the development of the kit:

1. Adequate equipment at the scene of use.
2. Complete facility in the transportation and administration of blood plasma.
3. Availability of all contents quickly and without removing anything from the kit.
4. Protection of contents from moisture and dust.
5. Speed in setting it up for use.
6. Compactness and fixation of contents in case the kit is dropped or tumbled about in transit.
7. Lightness and ease of carrying without sacrificing completeness and utility.

The first of the foregoing considerations is, of course, dependent upon the use to which the kit is put and will vary with the activity.

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[1] Received for publication June 16, 1942.

ADHESIVE
TAPE

MATCH
STICKS

RUBBER
BAND

CUFF FROM
RUBBER
GLOVE
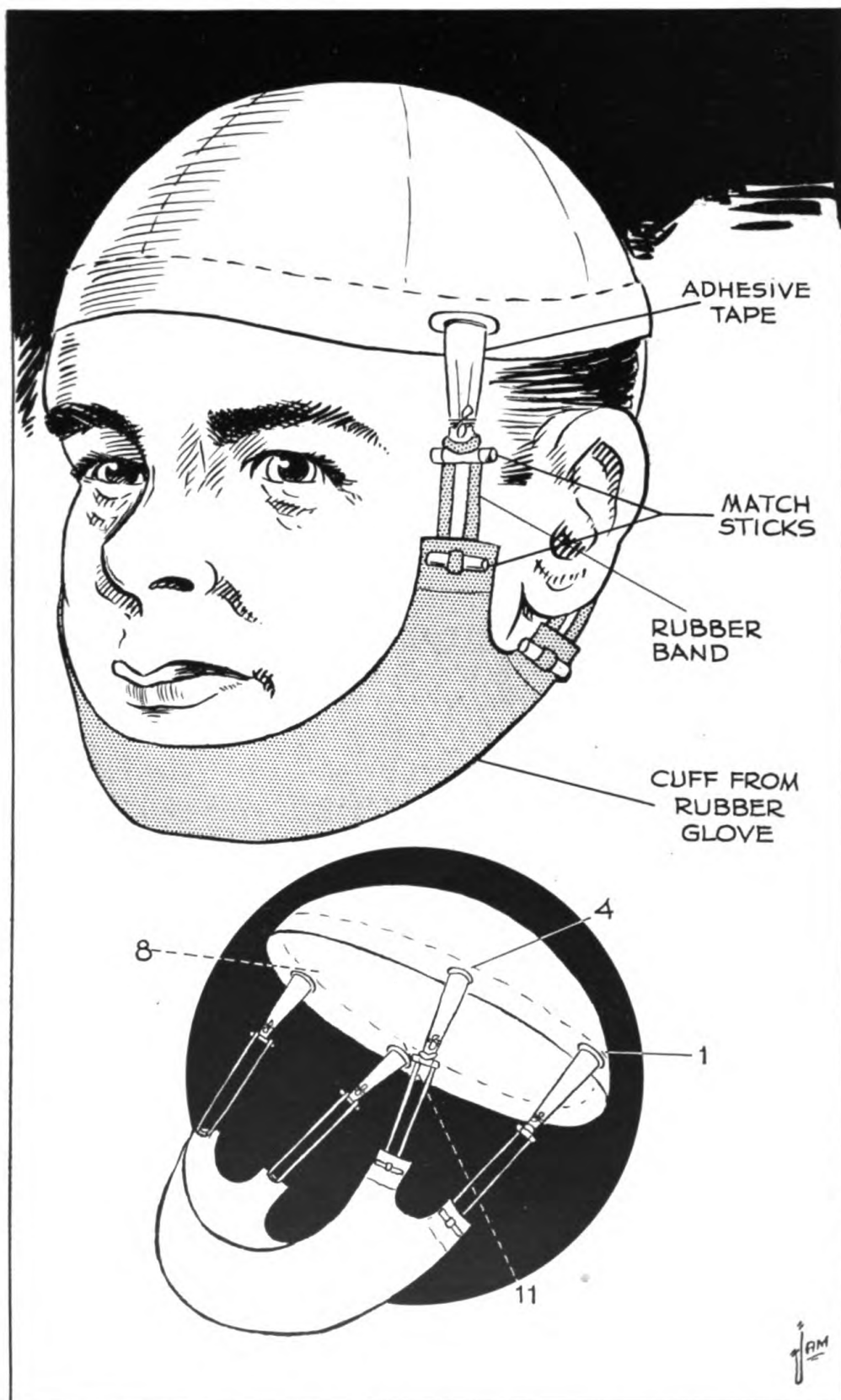
FIGURE 1.—SHOWING SUPPORT FOR FRACTURED MANDIBLE.
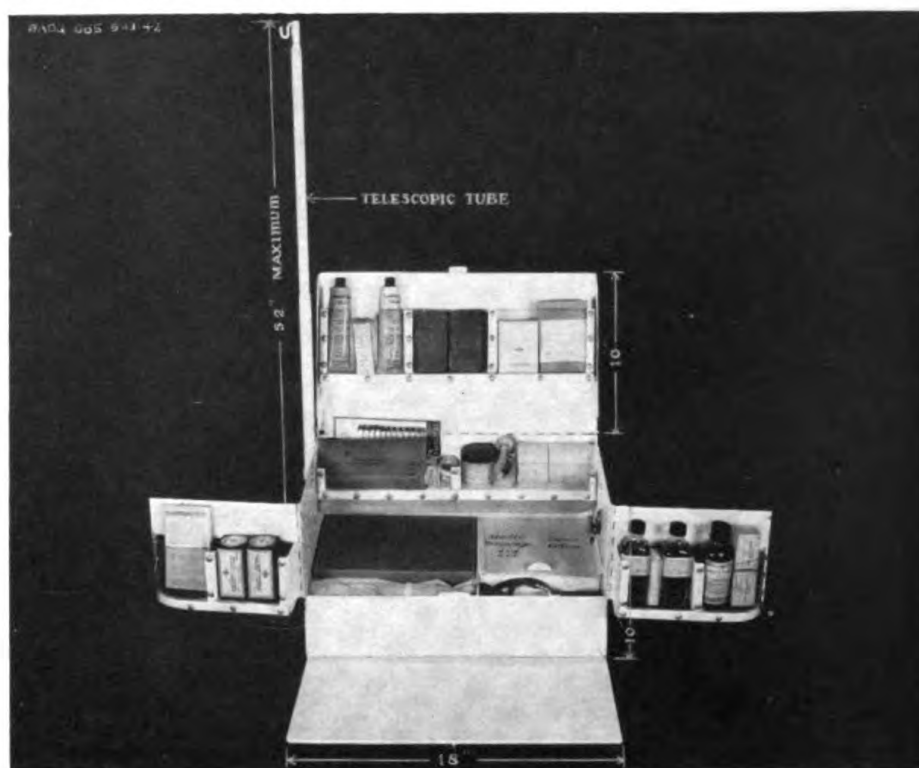
FIGURE 1.—FRONT VIEW OF KIT WITH FULL INVENTORY, READY FOR USE WITH
PLASMA STANDARD IN POSITION.
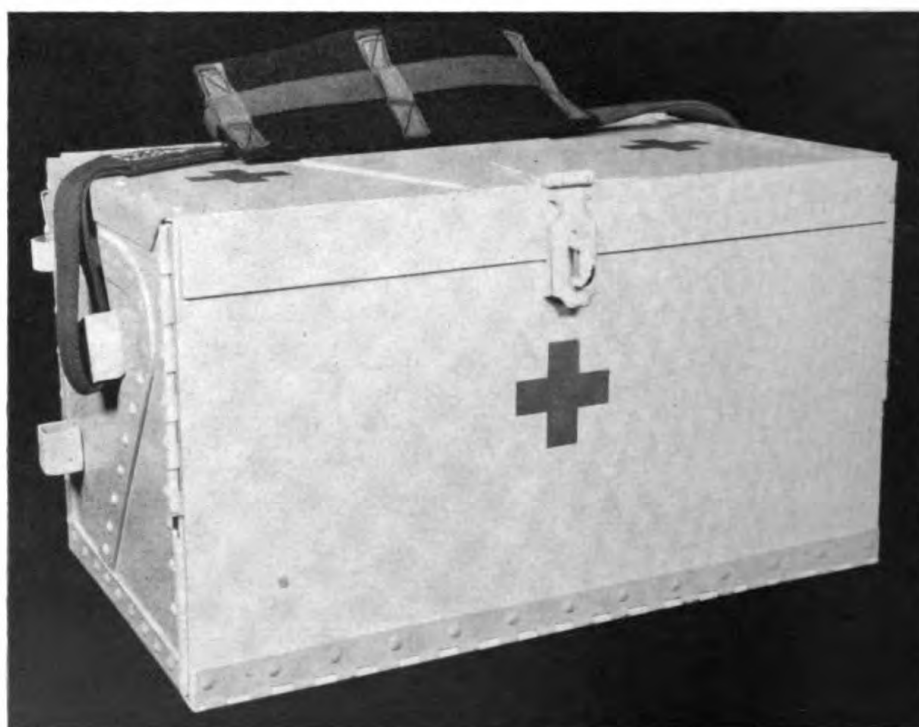
FIGURE 2.—VIEW OF KIT READY FOR TRANSPORTATION.

Adequate supplies of splints, antiseptics, morphine, stimulants, bandages, cotton, sutures, applicators, slings, instruments etc., as well as the plasma unit, can easily be carried in the space provided.

The administration of plasma under any circumstances has been provided for by the mechanical aspects of the kit's construction. The front wall of the kit is hinged at the bottom and may be dropped down flat on the ground to provide a space 18 by 10 inches as a clean surface on which to prepare for the transfusion or as a utility working surface for any other purposes. After the lid of the plasma kit is removed it can be replaced in its carrying space and the contents assembled on the above mentioned clean table without having to place any articles on the ground, about a boat, or on soiled shop benches. It is assumed that these procedures will be carried out at the side of the patient who will be on a stretcher or on the deck. Since excessive moving of the patient is impractical and an object on which to suspend the plasma container may not be available, we were prompted to add to the kit a telescope tube. This tube is made of three 18-inch lengths of light tubing which telescopes and is carried in a 1-inch square trough on the back wall of the box. The tubing when telescoped is held in by spring clips on each end of the trough and there is a hole drilled through the trough floor so that inserting a finger pushes the tubing up where it can be freed. The small-bore top section of tubing has a hook welded at its tip on which the wire bail of the plasma container is suspended after the tube has been inserted into a socket on the left end of the box. The height of the plasma jar can be varied by inserting provided pegs into the holes drilled thru the tubing at 4-inch intervals. The maximum height of the container with the tube at full length is 54 inches above the ground and this is ample to provide rapid flow into the smallest veins. The above factors should demonstrate that one medical officer or trained corpsman can easily administer plasma to a shock victim without assistance and with no dependence on anything not available in the emergency kit.

The construction is so arranged as to bring into view all contents of the kit when it is opened. This has been accomplished by building in compartments on the inner surface of the lid, on the inside back wall and on the hinged half-doors of the second front wall of the box. The lid, when opened, falls back slightly beyond the perpendicular and is held in that position by small chains. The hinged front doors open laterally thus exposing all four compartmented shelves, the fronts of which are made of transparent Plexiglas enabling the user of the kit to read labels and identify his materials

without search or removal. The compartments have been made to accomodate the standard Navy issue jars and 4-ounce bottles. Splints are stowed away beneath the shelf on the back wall and held there by spring clips attached to the rear wall. There is space for six to eight wooden splints to be slid between the clips and the shelf floor. On the right end-wall is a leather sheath for holding quickly available bandage shears. The floor of the box is divided into a space for carrying a plasma kit and into compartments with a slide top for sterile dressing, towels, gloves, etc. The remaining floor space takes care of any additional gear.

Protection of contents has been provided for by sealing the corners and having a flange along the edges of the lid which, with the second front wall, makes a dustproof container.

The entire box is secured by one hinged hasp from the lid to the outer front wall and when this is released the entire contents become available by the simple expedient of opening doors. Only a few seconds are required to begin work. Inasmuch as morphine is carried and must be protected, we are using lead-sealing metallic strips on the hasp. These are kept by the senior medical officer and are replaced after the box is broken open in use, but not until the inventory is again complete. The master inventory lists are also kept by the senior medical officer and the use of the seal eliminates daily inspection of the kit's contents. We know it is ready for use at any time after being checked out again following a crash or other emergency.

Compactness and safety of contents is assured because in construction the clearances of the shelves and their materials are so spaced that, with the box closed, each shelf locks the contents of its neighbor into place, and even though the kit is rolled around, all contents are still in place when it is opened. As an added safeguard for bottles, the compartments holding them are lined on floors and back walls with ¼-inch felt.

The problem of carrying has been solved by constructing the kit of light sheet metal which, of course, might not be available for a large number but could be replaced by many other materials such as plywood or the resinous plastics. (Micarta is one of the plastics which is supplied in both sheet and tubular form). A flat strap of parachute tape (900-pound test) is fastened through handles at each end of the box and a shoulder pad of felt attached to the strap which is of adjustable length by means of a buckle. This enables one or two men to carry it with ease. When being carried by one man the previously mentioned trough for the plasma standard, instead of

being an annoyance, assists in stabilizing the box if it is rested on the crest of one's ilium. This is accomplished by using the strap adjustment. The entire weight of the unit is approximately 28 pounds and although that may seem to be a considerable load the satisfaction of being able to do a job adequately and well at the scene of the accident justifies any slight inconvenience and transcends all other considerations.

The availability and use of such kits in quantity would seem to be an advantage in case of multiple casualties during air raid or other disaster. Each medical officer or other qualified person would be able to give adequate emergency care on the spot with no dependence on anything but his properly stocked kit. There may be and probably are criticisms to be made and desirable corrections in the present kit, but it was designed primarily for air station use and serves that purpose admirably.

A MODIFIED QUICK-ACTION BEAM CLAMP [1]

By Lieutenant F. E. Frates, Jr., Dental Corps, United States Navy

The clamp described in this paragraph is readily machined by any machinist from bar stock. It is designed for use over magazine trunks and the like to enable a rescue party to easily remove injured personnel. The clamp is secured by means of a set screw, readily turned to place by hand pressure, permitting itself to be attached to any beam such as that of the channel, L, T, or C types. By virtue of its light weight, the clamp can be machined to weigh less than 2 pounds so that it can be easily accommodated in the ordinary ship's first-aid box (fig. 1).

The use of such a clamp coupled with a belt or casualty sling will enable one man to descend to the bottom of a trunk, secure the injured person, and haul him topside for treatment.

On December 7, at Pearl Harbor, the placement of several of these clamps about the ship was made and one man rescued five who were overcome from smoke at the bottom of a 30-foot magazine trunk.

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[1] Received for publication April 1, 1942.
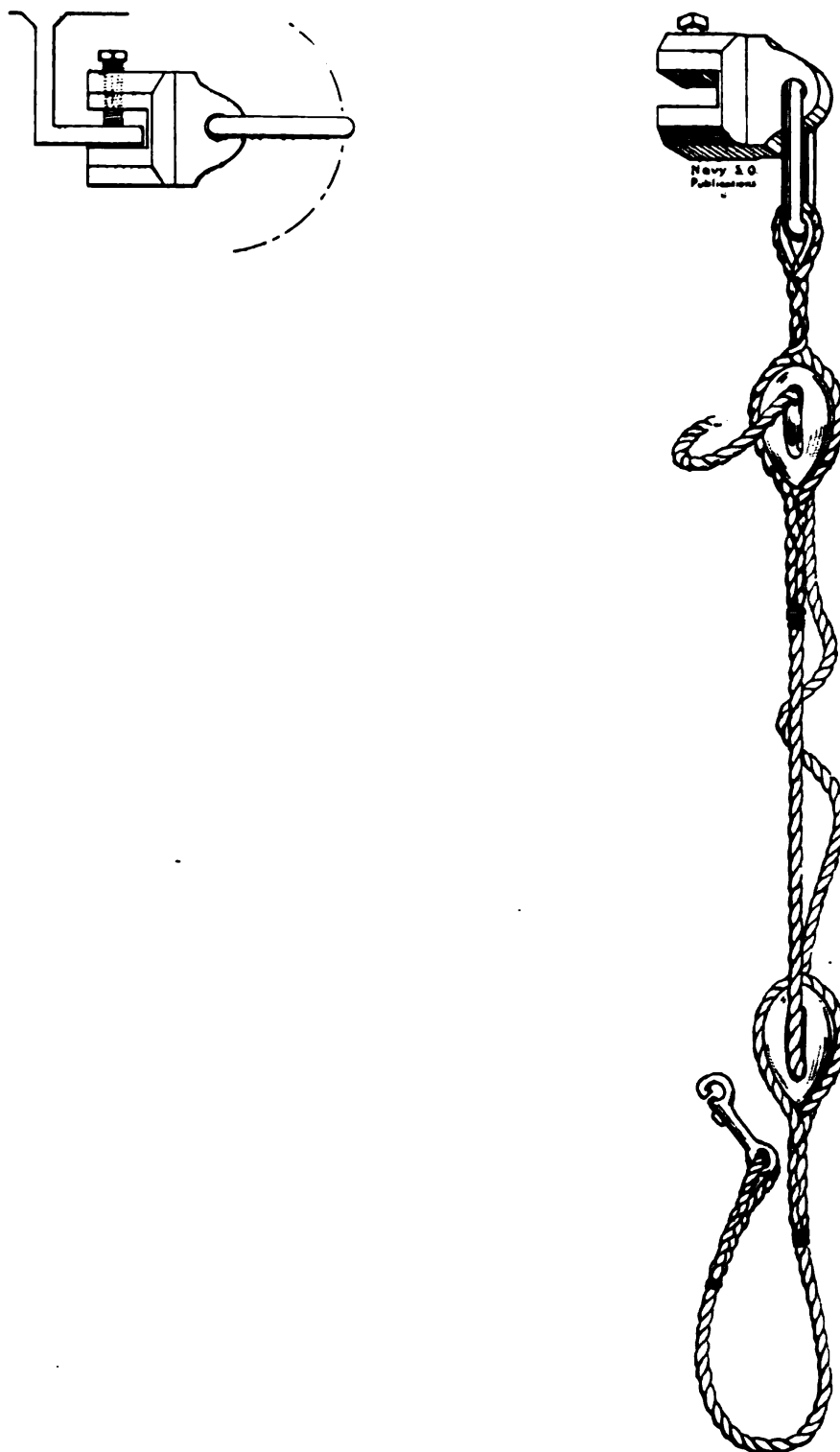
FIGURE 1.—Modified quick action beam clamp and hoist.

A ZIPPER STRETCHER FOR USE ON BOARD SHIP [1]

By Captain W. D. Davis, Medical Corps, United States Navy

The stretcher presented and illustrated (fig. 1) was designed to fulfill the requirements on board ship under war conditions.
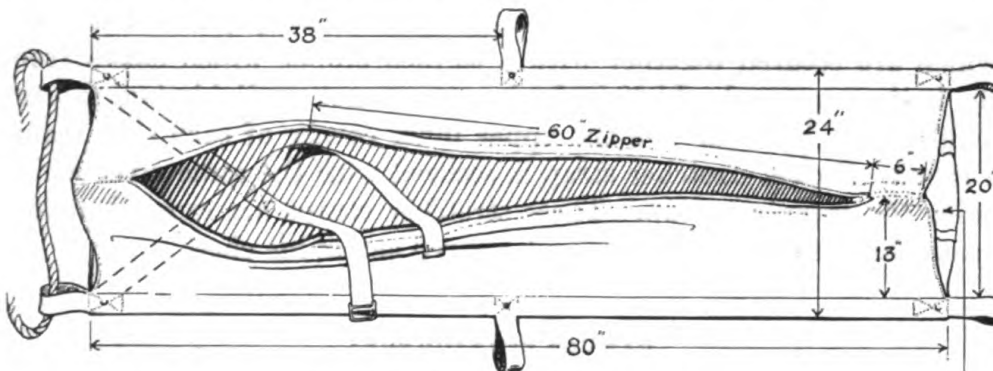
CANVAS ZIPPER STRETCHER
Triangular flap sewed to front piece to give room for feet.

FIGURE 1.

We found need of a stretcher that could be used in hoisting or lowering patients through hatches 18 inches in diameter. Neither the Army litter nor Stokes stretcher will pass through these openings. This stretcher has been found to be serviceable in removing patients from lower decks or in taking patients from topside down to the sick bay. The canvas front is loose enough so that patients with leg splints can be placed in the stretcher. By means of a block and tackle, a number of stretcher cases can be hoisted through an escape hatch in a very short time. It can also be used in transferring patients at sea or in lowering them over the side into small boats. It has the advantage over the Stokes stretcher in lowering patients over the side in that it can be done more easily. It has also been found serviceable in handling violent mental cases.

The patient is placed in the stretcher, the straps buckled around his chest and the zipper drawn up. He is free to move around in the stretcher but cannot get out. The straps, which are secured to the upper ends of the poles, cross in the back and buckle across his chest. This supports the patient when suspended and keeps him from sliding down inside of the stretcher should he become unconscious.

We have had 18 of these stretchers made on board this ship and distributed among the 5 battle dressing stations.

They are made as follows: The side frames are two hardwood poles 80 inches long and 2 inches square. The canvas is No. 6 chrome-dyed and the bottom width of the stretcher inside the frame is 21 inches,

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the top width inside the frame is 26 inches. The canvas is sewed around the pole frame with No. 8–6 white cord. There is a 1¾-inch wide white canvas carrying strap at each end of the poles and one on each side in the middle. These straps are sewed to the inside of the canvas covering and then secured through the poles with a 2½-inch brass rivet. The top is composed of two canvas strips, 13 inches wide, which are secured together with a 60-inch zipper which closes from the bottom upward. If 60-inch zippers are not available two shorter lengths may be used. On the upper inner corner of each pole frame a regular Stokes stretcher strap is secured with the same rivet which holds the carrying strap. These stretcher straps are crossed underneath the patient's shoulders and secured across his chest.

CANVAS STRETCHERS [1]

MODIFIED NEIL ROBERTSON TYPE

By Lieutenant Commander Thomas M. Arrasmith, Jr., Medical Corps, United States Navy

The idea of the canvas stretcher is in no sense new. Such stretchers are, and for a long while have been, extensively used by the British, who still employ them.

The desirability of having available such means of removing injured and wounded from spaces in ships that are inaccessible to either the Stokes or Army litter type of stretcher has also been appreciated by our Navy, as exemplified in the development of the Webber zipper stretcher.

REQUIREMENTS

Such a stretcher should embody the following features to meet the conditions under which it is to be used:

1. It should be of such construction as to be readily employed in spaces which are inaccessible to the Stokes or Army litter type of stretcher. To this end, provision should be made for both the horizontal carrying of the rescued and for a vertical hoist through hatches, up trunks, etc.

2. It should be as light as possible, consistent with the strength of construction required.

3. It should possess both flexibility and protective rigidity (splinting effect for major fractures) ; these factors, preferably, subject to modification to meet the demands of a given situation.

4. It should be capable of stowage in a minimum amount of space, in order that many stretchers may be stowed at appropriate points throughout the ship without interference with the activities of other personnel.

5. It should be of rugged construction and capable of functioning in spite of abuse and exposure to the elements (stowage on topside, in masts, etc.)

6. It should be simple of application, in order that it may be employed by non-medical personnel in cases of emergency.

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[1] Received for publication May 5, 1942.

7. It should be of one unit construction, both to insure the fact that it will be on hand in its entirety when needed and to obviate the necessity, and possible confusion, of its having to be assembled before being put in use.

8. Materials employed should be available in this country.

9. It should, preferably, be capable of production aboard ship.

The appliance herein described seems to meet all the requirements in question. It is not in any sense original with the writer. Rather is it a modification of the British Neil Robertson stretcher to meet these requirements more effectively in our ships and an adaption of it to production from materials now obtainable in this country. A figure of a type model of this stretcher is to be found on page 254 of *Pryor's Naval Hygiene*, 1918. It is made of heavy canvas, reinforced with strips of bamboo. It buckles around the patient and is provided with a carrying ring at either end. In addition, there are two loops of rope on either side, one near the shoulders and one at about the middle of the lower leg, for four stretcher bearers. By the attachment of a line to the upper carrying ring, the patient may be hoisted vertically. All lines are sewn to the canvas for required strength and safety. It is 56 inches long over-all.

An original model was made from drawings of such stretchers obtained from H.M.S. *Prince of Wales*, substituting oak battens for the bamboo reinforcements. Our battens were cut $7/8$ by $1/4$ inch in cross section. Six such battens were run the entire length of the stretcher.

When put to practical tests, certain faults with this stretcher which required modification to adapt it to efficient use on our ship, were immediately apparent. Due both to relative weakness of the battens and the attachment of the upper carrying line to the extreme upper end of the stretcher, far too much flexion of the patient occurred when carried in the horizontal position by but two bearers. There was also a distinct tendency for the patient to roll about his own long axis, the result of a greatly narrowed carrying base at the point of attachment of the lines.

Finally, the feet of the casualty projected some 8 to 10 inches beyond the lower end of the stretcher. There is, therefore, no splinting effect here for lower leg fractures.

As finally modified, we feel that most, if not all, of the objectionable features of this first experimental model have been eliminated and that the product now recommended goes far toward filling the requirements that such a stretcher should theoretically meet.

A MODIFIED NEIL ROBERTSON STRETCHER

The general outline of the stretcher remains unchanged. More rigidity has been obtained through increasing the cross section of

the individual batten to 1 by ⅜ inches. Seven of these battens instead of six, run the entire length of the stretcher. The attachment of the upper carrying line has been shifted from the end of the stretcher to two points back of the shoulder. This, through affording a wider base for the upward application of the carrying force, eliminates the tendency for the patient to roll. The carrying ring attached to the lines is changed to a triangle, furnishing a much broader carrying surface for the hand of the stretcher bearer and affording a firmer grip. At the head end, one line leading from the triangle attaches to the stretcher by a snap. Thus when a horizontal carry is to be undertaken, the line is snapped across the throat of the patient to the triangle. When a vertical hoist is anticipated, the line is snapped across the back of the patient's neck.

NOTE.—If the lines leading from the head end of the stretcher to the triangle are made long enough to be thrown over the patient's head for a vertical hoist, as is one's first inclination, thus eliminating the snap, it will be found that they are entirely too long. When carried in the horizontal position, the patient's head will not then clear the deck sufficiently to avoid the danger of trauma from ladders, hatch coamings and door sills, unless the stretcher bearer carries with his arm flexed. This is too tiring for efficiency. Measurements for these lines are shown, with all other cardinal ones in figure 1.

In length, the stretcher has been increased from 56 inches to 70 inches. This is sufficiently long to encase the entire length of leg of the casualty and affords very efficient splinting in case of fracture of both the upper and lower leg. It should be noted that this splinting effect is greatly enhanced by the two longer battens in the overlying skirt, which run from the hip of the patient all the way to the foot. These two battens, when the stretcher is applied to a patient, are "on edge" and take the strain against their wider dimension, bending scarcely at all.

In all parts of this stretcher, the splinting effect (rigidity) can be modified at will to meet the requirements of a given situation by manually removing battens as desired. To this end it will be noted that the upper end of the pocket for each individual batten has been left open, the batten projecting approximately 1½ inches beyond the canvas.

A situation in which this feature might be utilized is that of fracture of the spine. Here the patient is carried in the horizontal position, face down, upper carrying line snapped across the back of the neck. By the removal of a sufficient number of the long battens, the desired degree of hyperextension is obtained.

When rolled upon itself and secured by its straps, the stretcher can be stowed in a minimum of space, the most convenient stowage usually being that of suspension from an overhead frame or pipe line.

The modified form of this stretcher, as described, is not recommended in lieu of the Stokes splint stretcher, but as a supplement
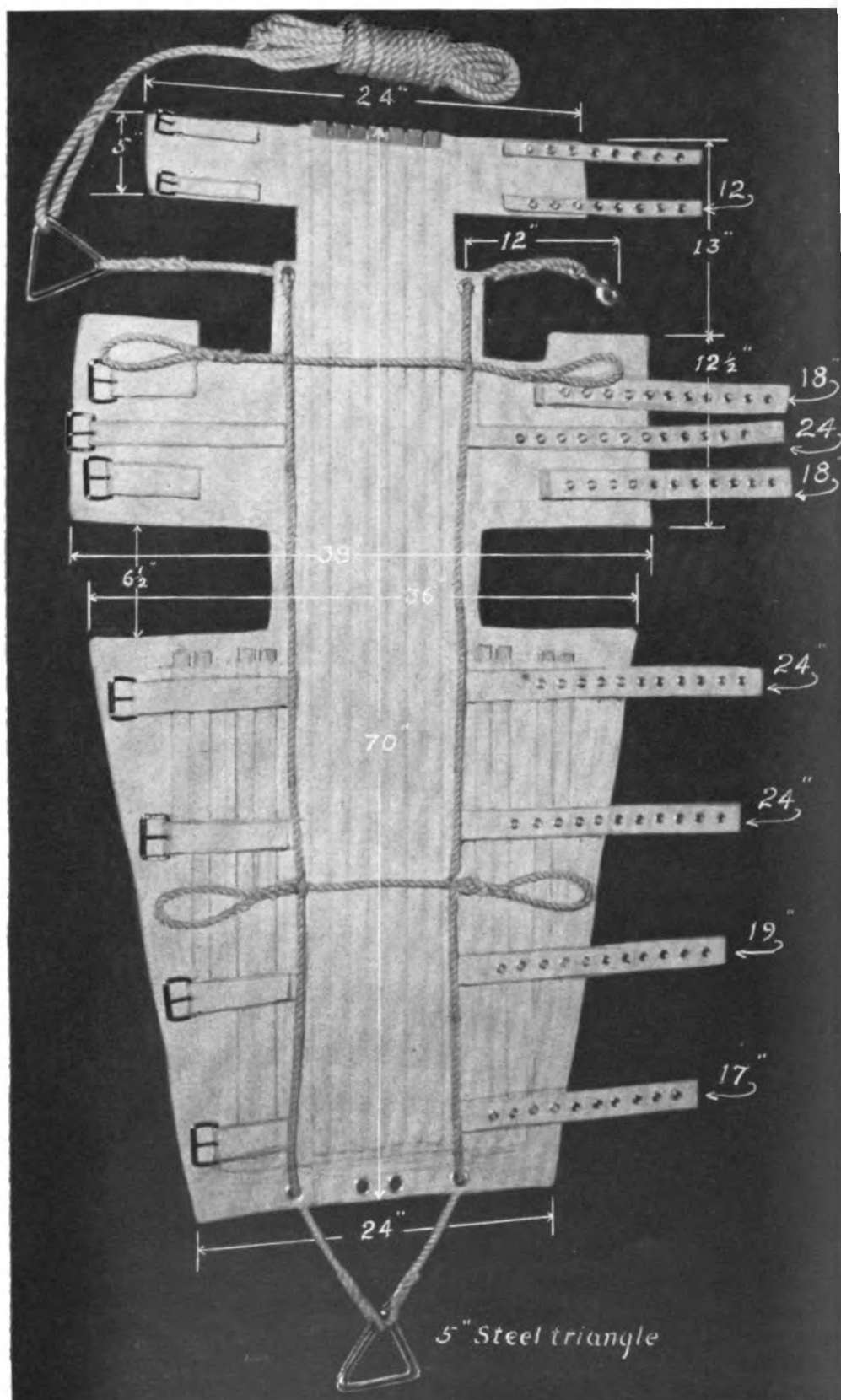
FIGURE 1.—MODIFIED NEIL ROBERTSON STRETCHER, GENERAL PLAN. PHOTO
GRAPH TAKEN FROM BACK OF STRETCHER.
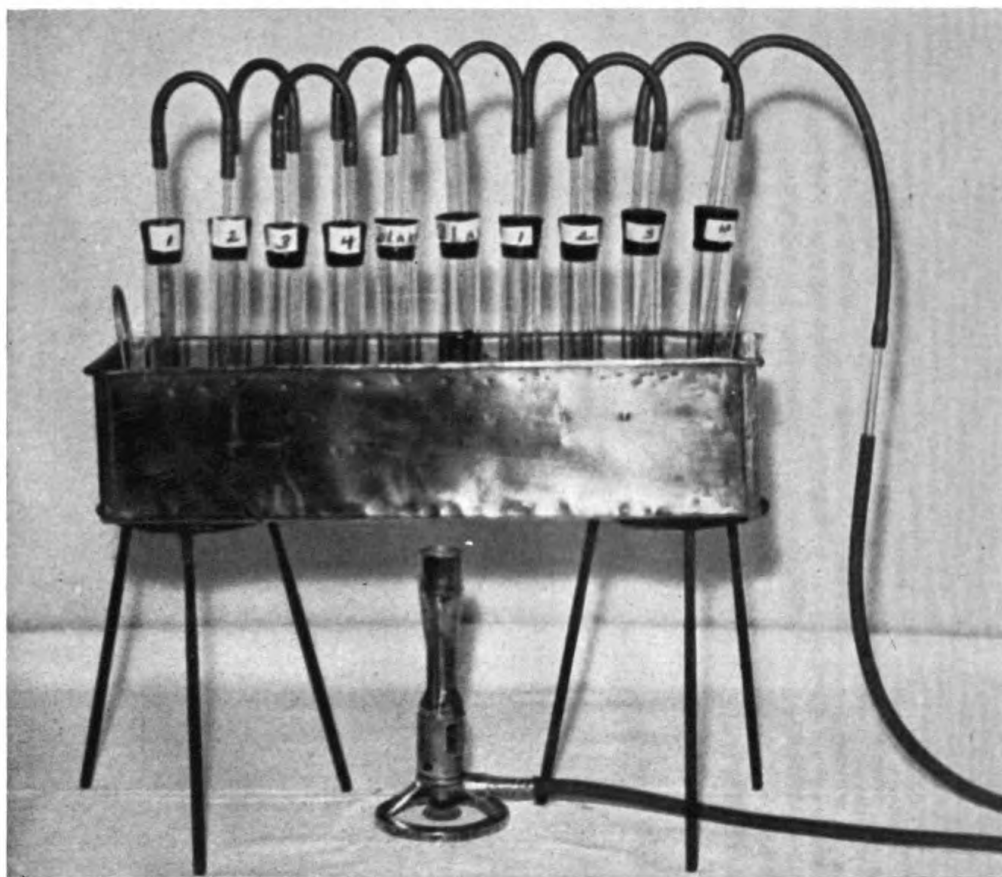
FIGURE 1.—ASSEMBLED APPARATUS SHOWING WATER BATH.
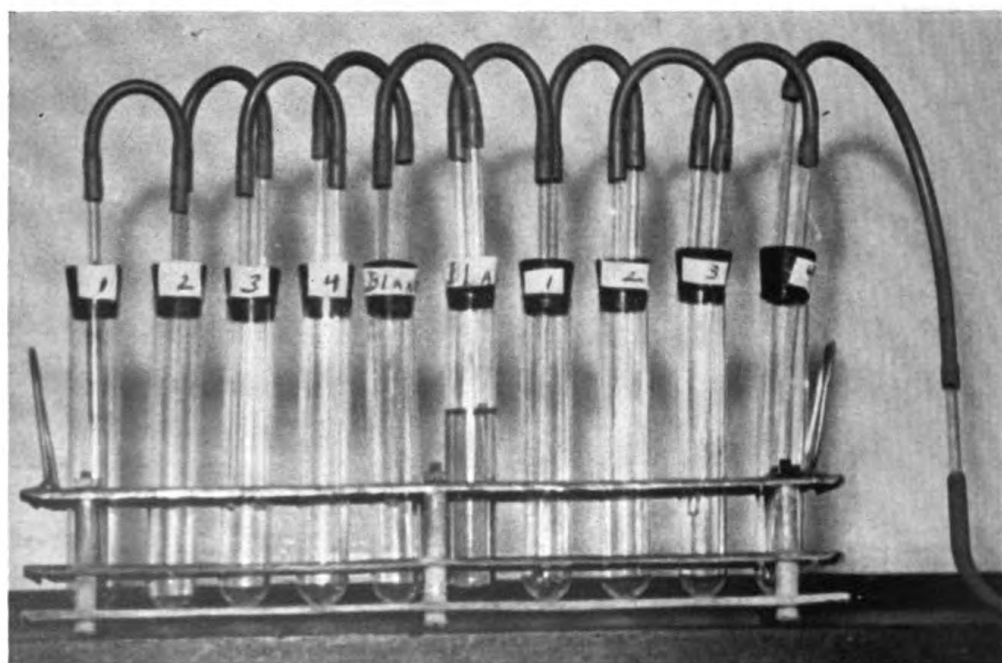
FIGURE 2.—SHOWS DETAIL OF RACK CONSTRUCTION.

thereto; and, if carried in the numbers detailed for British ships, it is well appreciated that, with the present increased allowance of the Stokes type, such numbers would be in excess of our needs. It is believed, however, that if stocked in numbers to fill the allowance of such appliances for the individual ships, it will go far toward solving the problem of the canvas stretcher.

LABORATORY APPLIANCE FOR DETERMINATION OF ALCOHOL BY BOGEN'S METHOD [1]

By Lieutenant, junior grade, L. C. Posey, Medical Corps, United States Naval Reserve, and Pharmacist's Mate, second class, W. E. Berkley, United States Navy

Because of the necessity for frequent alcohol determinations, the apparatus herein described has been made. Since alcohol estimations are commonly done on blood and urine simultaneously, and often on more than one individual, it was considered desirable to construct an apparatus with which at least two tests could be performed at one time. Most of the tests for alcohol are based on the principle of reduction of acid bichromate by volatile reducing substances. The reactions will occur with any volatile aldehyde, ketone, or alcohol. It may be important to emphasize that anesthetic ether, ketone bodies, and formaldehyde give positive reductions. This should be borne in mind with the interpretation of the results. Diabetic coma should not be confused with acute alcoholism even though an individual may have an alcoholic breath. Alcohol determinations are of no value when done on bodies embalmed with alcohol or formaldehyde.

The apparatus is adapted for use in the procedure described by Bogen and illustrated in the Naval Medical School Methods for Blood Chemistry, page 42a. Two sets of the four-tube apparatus there illustrated are separated by an additional two tubes with similar connections. The gross series of 10 tubes is supported in a specially designed metal rack. The rack fits into a metal water bath that is constructed to match the rack. The tubes are connected in series with a hydro aspirator. The 2 tubes separating the two series of 4 tubes each serve as traps. The first is left empty and the second contains the acid bichromate mixture. This arrangement prevents discharge of volatile reducing substance from the first to the second series of tubes. With low concentrations of alcohol, such as encountered clinically in urine, gastric juice, and blood, no loss has been observed to occur in the "trap" tubes. These trap tubes, although not usually necessary, serve as a safety precaution.

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[1] Received for publication May 22, 1942

The bath and tube support were made from scraps of copper metal, hollow metal tubing, and bolts and nuts to fit. The seams of the bath were sealed with solder. The bath (fig. 1) has an over-all measurement of 40 by 10 by 10 cm. The tube support (fig. 2) measures 38 by 9 by 7 cm. Two 10-hole perforated shelves were considered desirable to prevent lateral mobility of the tubes. The bottom shelf is not perforated and serves as a base upon which the tubes rest. The long handles at each end of the tube rack facilitate handling of the connected apparatus without disturbing the suction pressure.

This apparatus has the following advantages:

1. Reduction of glassware breakage (tubes are supported sturdily and no beaker is required).

2. Airtight seal is assured (there is less mobility).

3. Less suction force is required.

4. Less heat is necessary (the rack surface serves as a lid for the boiler, thus preventing considerable heat loss).

5. Two tests may be performed at one time.

TRACTION TREATMENT OF FRACTURES OF THE METACARPALS, METATARSALS, AND PHALANGES [1]

By Lieutenant L. F. Friend, Medical Corps, United States Naval Reserve

A method of treating certain difficult fractures of the hand and foot by means of elastic traction is herein presented. It is practical, effective, and does not require elaborate equipment.

The method is applicable to spiral, oblique and comminuted fractures of the metacarpal, metatarsal and phalangeal bones. It is also useful in maintaining constant traction on the distal fragment of fracture of the radius, when necessary to prevent shortening, by means of traction through thumb and index finger. It is considered unnecessary in the treatment of fractures without displacement and simple transverse fractures.

The following material is necessary and is shown in detail in figure 1:

MATERIAL

1. Strong wire for banjo loop, such as a coat hanger.

2. Local anesthetic, 2 percent procaine.

3. Hypodermic syringe, 10 cc. or 20 cc. Hypodermic needle, 26-gage for anesthesia. Intravenous needle, 20- to 24-gage by 1 inch for traction pin.

4. "U"-shaped metal bow, preferably aluminum, made from a strip 3¼ inch by ¼ inch by ⅟₁₆ inch, drilled about ¼ inch from both ends to engage the traction pin. These little traction bows can be made by any machinist or sheetmetal worker.

5. Wire-cutting pliers.

6. An ampule file.

7. Plaster for cast.

8. Rubber bands.

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[1] Received for publication April 13, 1942.

TECHNIC

The technic includes three steps:

1. Transfixion of the digit with an intravenous needle which becomes the traction pin.

2. Application of a plaster cast with banjo wire loop for countertraction.

3. Application of rubber bands from the banjo loop to the traction pin through the medium of the metal bow.

After surgical preparation of the finger, the site of transfixion is anesthetized on both sides, using a 26-gage needle. A larger needle is then substituted and forced through the bone by rotating the syringe back and forth as a drill.

The site of transfixion varies with the location of the fracture, but is always the cancellous epiphysis of the bone An attempt to perforate the hard shaft of the bone results in a bent or twisted needle.

For a metacarpal fracture, the distal end of the proximal phalanx is preferred, as exercise of the joints beyond the pin is thus allowed; for a phalangeal fracture, the base or tufted tip of the terminal phalanx may be selected. The tip of the phalanx will be encountered halfway back along the fingernail and just below its margin.

A 20-gage, 1-inch needle is ideal for transfixion. It is less likely to bend in perforating than a longer needle and will stand a strong pull. One employs the most suitable needle available, sometimes using the same needle for injection and transfixion.

When the needle has been drilled through, the syringe is removed and the needle ends clipped off with cutting pliers, or scored with an ampule file and broken. The ends should extend about one-quarter inch on each side.

A plaster cast is applied to the forearm, extending from below the elbow to the metacarpophalangeal joints and a banjo or hairpin loop incorporated into it, to extend well beyond the fingertips. This loop, made of 14- or 16-gage wire should be prepared before the cast is started and shaped to parallel the relaxed fingers, in most phalangeal fractures. Some require straight or even hyperextended traction. Short, right angle bends in the wire ends prevent the loop slipping in the plaster. The most common mistake is failure to extend this loop far enough beyond the fingertips, which results in the traction bow being drawn clear to the loop by the rubber bands.

When the cast with the incorporated banjo has set, the application is completed by springing the metal bow over the ends of the pin, looping one end of a rubber band through the other end, around the bow, and stretching it over a notch in the countertraction loop and back through the bow. It is secured by weaving a piece of applicator over and under the band.

Traction is varied by the tension put on the band.

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When muscle pull, which is responsible for maintaining maladjustment of fracture, is overcome by steady traction as obtained by such an application, often the deformity will be reduced easily. Frequently the traction will correct the deformity in a few hours without manipulation.

When correction has been obtained, as shown by x-ray, minimal traction will usually suffice to maintain it.

With evidence of healing, the rubber bands may be released for periods of gentle exercise and then reapplied.

In treating such fractures of the metatarsals and toes, the same method may be employed. In making the application to all except the great toe, the needle may be transfixed in a dorsoventral direction to obviate embarrassment of adjacent toes by the needle ends.

My contribution to the technic is the suggestion of the simple metal traction bows. Commercially manufactured traction bows and pins can be purchased, but the method as herein simplified can be used on ship or ashore.

Emphasis should be made on the following points:

1. Large, short needle; if available, 20 gage by 1 inch is ideal.
2. Transfix the end of the phalanx. Avoid the hard shaft.
3. Study of the x-ray determines the direction of traction desired usually parallel to relaxed finger.
4. Daily mild exercise periods after healing is in evidence.
5. X-ray control.

Figures 2, 3, and 4 illustrate a practical application of this traction splint.

CONCLUSION

A presentation of the principles of elastic traction has been given, indications for its use, and a simplified technic described.

Applicable on board ship or ashore, it is hoped that the method may be of assistance in treating certain fractures.

Photographs taken by S. C. Walters, PhM1cl., U. S. N.
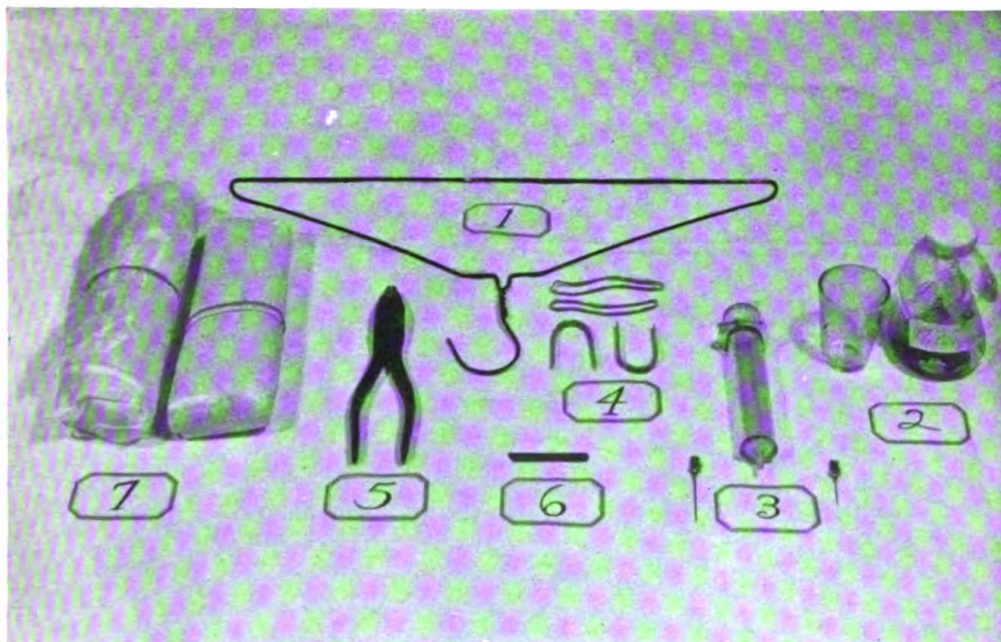
FIGURE 1.—SHOWING MATERIAL NECESSARY IN TRACTION TREATMENT OF
FRACTURES.
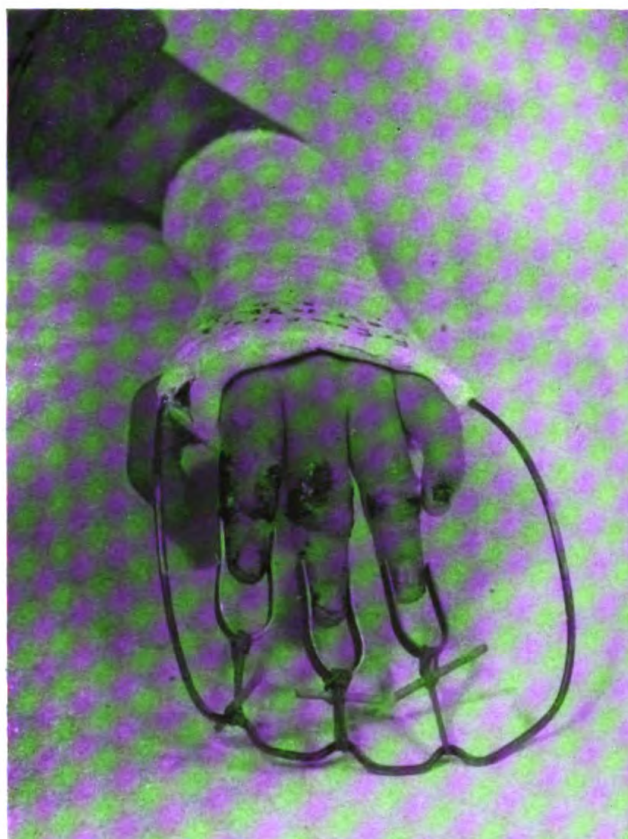
FIGURE 4.—TRACTION APPLIANCE MAINTAINING APPROXIMATELY NORMAL LENGTH
OF FINGERS. NOTICE SIMPLICITY AND THE EASE WITH WHICH THE FINGERS
CAN BE DRESSED. SAME CASE AS FIGURE 3.

FIGURE 2.—COMPOUND FRACTURE OF SECOND, THIRD, AND FOURTH FINGERS MIDDLE PHALANGES FOLLOWING GUNSHOT WOUND.
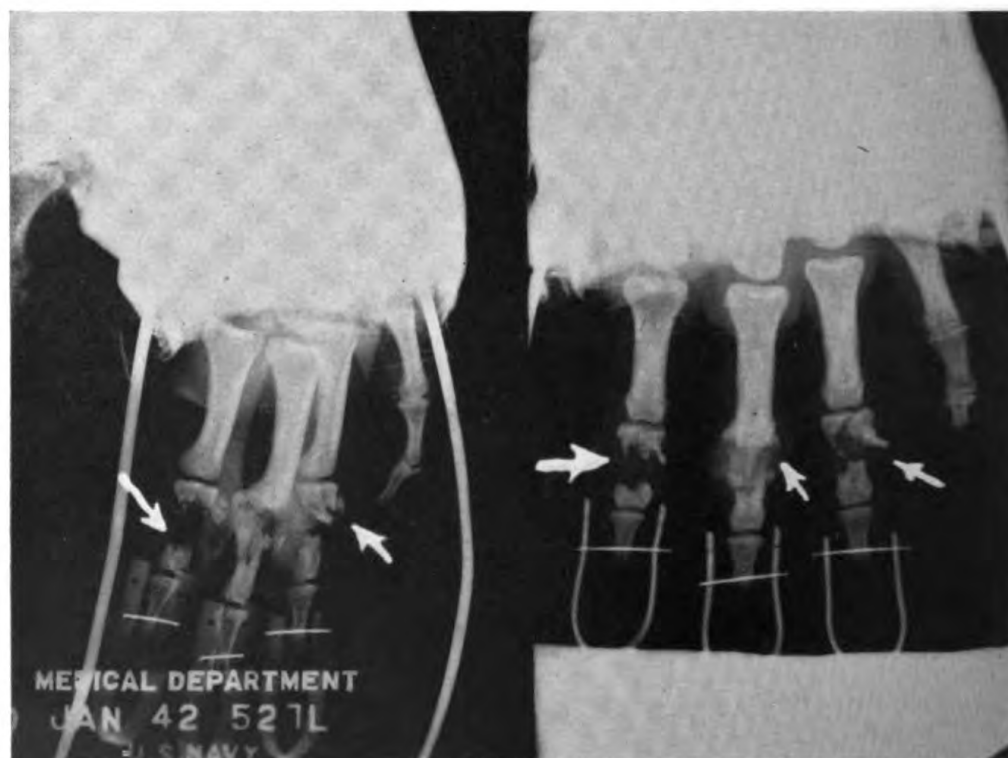
FIGURE 3.—X-RAY IN TRACTION APPLIANCE. WHAT APPEARS TO BE OVEREXTENSION, IS ACTUAL LOSS OF BONE DUE TO INJURY.

NOTES AND COMMENTS

This October issue of the Bulletin is a dental number. The leading article and several other articles in this issue are by dental officers, special notes and comments on dental matters have been included, and book notices of several recently published dental books are in the Book Notice section. Of course, the issue contains many purely medical articles, but dentistry, and particularly dentistry in the Navy, has been given prominence in it.

With the growth and importance of dentistry in the life of the Nation, there has been a realization that the best in dental care is essential for the men in the Navy and Marine Corps in order to keep them fit to carry on the important task of national defense.

Dental caries is a disease which afflicts more individuals than any other illness. Until the cause of this malady is discovered, the most effective preventive measure is to correct the progress of tooth decay by filling and restoring teeth to function, rather than extraction, thus saving as many teeth as possible and bringing the mouths of the personnel to a state of health and keeping them dentally sound.

In order to furnish the best of dental service to the Navy, the Medical Department has provided funds for obtaining the finest dental equipment and supplies so that the new dental clinics in navy yards, air stations, hospitals and training stations, manned by naval dental officers, may render the highest type of dental treatment.

The Planning Division of the Bureau of Medicine and Surgery has redesigned and standardized prosthetic dental laboratories in many of our activities. Nonprecious metal and acrylic resin are widely used as restorations. New materials, successfully used, encourage the naval dental officer to accomplish better dental service.

The wartime problem of the naval dental officer is extremely difficult, especially at sea. The fleet is underway for considerable periods of time, stripped for action, necessitating curtailing the amount of dental treatment available. The dental officer has demonstrated his capabilities as assistant to the medical officer under actual combat time and time again.

Under conditions of war naval dentistry emphasizes two important aspects of dental service. Maxillo-facial surgery and prosthetic

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dental restoration are assuming paramount importance. The war-time demands of this phase of military dentistry have not been appreciated as yet. In order that the Navy Dental Corps will be ready when these phases of dentistry are indicated, dental education along these lines has been instituted in collaboration with the Mayo Foundation at Rochester, Minn.

In the National Naval Medical Center, Bethesda, Md., the Medical Department has set up agencies for research and education. The dental officers in the Center, in conjunction with medical officers, have projects underway concerning dental disease and its prevention. A progressive, active, Dental Corps must assume responsibilities by assisting in solving these problems in dental diseases. The Schools of Medicine and Dentistry at the Medical Center offer the greatest opportunity for scientific instruction. Dental progress is vitally associated with education and research.

The Dental Corps has expanded considerably from 289 officers on the rolls in 1939. There has been a great increase in active duty assignments of dental Reserve Officers. Their skill, patience, and devotion to duty are the qualities which contribute to insure fitness to the naval establishment and its personnel.

PRINTED CHANGES AND ADDITIONAL COPIES OF THE MANUAL OF THE MEDICAL DEPARTMENT

Embodying changes in the Manual of the Medical Department, chapters 11 and 19, and several miscellaneous pages on which considerable changes have been made, have been reprinted and are available for distribution. These will be sent to holders of the Manual on request. In addition, a number of copies of chapters 11, 19, and 21, have been reprinted in pamphlet form for convenience of desk reference. These have always been very popular and useful. A number of additional copies of the entire Manual also have been printed so that the needs for it due to the increasing expansion of the Navy can be met.

PALMING AMALGAM

E. W. Skinner and J. R. Jarabak, of Northwestern University, have demonstrated that palming of dental amalgam in the hand may with time cause excessive expansion.[1]

Souder, Beall and Schoonover, at the National Bureau of Standards, have attempted, as time permitted, to verify these findings and present the following preliminary report:

[1] Unpublished communications.

1. Clean alloy mixed in a standardized mechanical amalgamator and packed in a steel die without being touched by the hand gave the normal expected, desirable expansion during the first day; then did not change so much as ±0.2 micron per centimeter during any one or all of the following twenty days.

2. Alloy contaminated by contact with the moist palm and fingers (unwashed in 2 hours) gave near the normal expected expansion during the first day. The expansion, however, continued each day thereafter and, at the end of 12 days, had reached the enormous amount of 100 microns per centimeter.

3. Clean alloy amalgamated and packed as indicated above, except that a drop of saturated sodium chloride solution was added to the alloy before amalgamation, also expanded excessively, in fact almost identically in amount to that of the palmed alloy as reported above.

This confirms the findings of the earlier workers, and suggests the measures necessary to prevent the occurrence of this unfavorable phenomenon in practice.

The tests are being continued and may be reported in greater detail in a later communication.

For the present, the Research Commission recommends either the use of (a) a clean mortar and pestle, omitting the palming operation; (b) the mechanical amalgamator (time rated in seconds and accurately controlled for the respective alloy) without palming, or (c) scrupulous cleansing and drying of the hands if the operator persists in the apparently dangerous practice of palming the alloy.

<div align="right">

M. D. Huff, *Chairman,*
Daniel F. Lynch, *Secretary,*
Executive Board, Research Commission.

</div>

NOTE.—A portion of this note has been reproduced from the Journal of the American Dental Association, 28 : 830–831, May 1941, through the courtesy of the Association and the Research Commission.

THE USE OF MICROCRYSTALS OF SULFATHIAZOLE IN SURGERY

After sulfanilamide received the early and deserved recognition as a local application of the powder in the prophylaxis and treatment of infections, its action against many of the contaminating organisms was less effective than had been hoped for. Many clinical investigations have shown that sulfanilamide is only weakly effective against staphylococci, colon bacilli and the gas gangrene organisms. Of the many casualties treated in the Western Desert and Libya, the wounds were found to be heavily infected with staphylococci and slow in healing.

On the other hand sulfathiazole appears to be an ideal compromise. Not only is it effective in proper concentrations against the streptococcus but also against the staphylococcus, the colon group, Pseudo-

monas aeruginosa, Proteus vulgaris, Clostridium perfringens, Clostridium septicum and Clostridium edematiens, and even somewhat against tetanus.

The chief disadvantage against the use of sulfathiazole is its tendency to clump and form insoluble masses which may act as foreign bodies in the tissues, and another disadvantage is that it is less soluble in a watery solution. In some cases it may be desirable to inject a neutral suspension of this drug through a fine hypodermic needle which in the past has been impossible due to the size of the particles.

This disadvantage can be overcome by reducing the macrocrystals of this drug to microcrystals by sonic agitation, so that the crystals pass easily through a 26-gage needle. The microcrystals are fairly uniform in size, and aqueous suspensions below 30 percent by weight are stable and show little tendency to settle. The absorption is consequently more rapid and the blood level is maintained at a higher level than when the macro preparations were used. A fine powder of microcrystals may be made by centrifugation or filtration and the sediment dried to a fine powder.

Shaar, Ferguson, and Nova on page 954 of this issue and Chambers, Schumann, and Ferguson, in the May 23 issue of the Journal of the American Medical Association, have shown their results with the use of the microcrystals of sulfathiazole powder in the treatment of burns. The latter states:

Our experience with the use of sulfathiazole in burns has been rather limited, but the results have been so striking that they are worthy of mention. The burns have been treated by excision of the burned areas and blebs and the application of powdered sulfathiazole by a powder spray. The burned areas were then covered with moist saline dressings which were moistened every 3 hours with a syringe. Except for the first 24 hours, when the pain was relieved by morphine, the burned areas were painless. The same applications were made until healing was complete. In these cases, the absence of unhealthy granulations so frequently seen with applications of sulfanilamide was noticeable. In spite of a large burned area, the blood level of sulfathiazole was never more than a trace.

They have also used it in wound infections and state that their results with the local use of the microsulfathiazole in 30 traumatic wounds and 57 cases of infection have been favorable. It was also used in suspension in the abdomens of 19 patients with no untoward results.

RECOMMENDED PRONUNCIATION OF THE SULFONAMIDE DRUGS

The recommendations of the Committee on Nomenclature regarding the pronunciation of the words *amide*, *sulfanilamide*, and *sulfathiazole* have been accepted by the Council on Pharmacy and Chemistry of the American Medical Association.

The recommended pronunciation of the word *amide* by the Committee is with a long *i* (*amīde*), this being preferable both because of the final *e* and the analogy with chloride and iodide.

The Committee also recommended the pronunciation of *sulfanil-amide* to be *sulfanil'amīde* for the same reason, the major accent being on the antepenultimate syllable, *il'*.

The preferred pronunciation of *sulfathiazole* should be on the syllable *thī*.

The American Chemical Society has also made the same recommendations.

GAS MASKS AND RESCUE MASKS

One of the difficulties which the various navies of the world engaged in the present war have had to meet in naval combat is the presence of smoke and fumes from bursting bombs and other projectiles in the closed spaces of a ship. Many of these gases are highly toxic and in addition most of the oxygen in the spaces has been combined with other elements so that a condition of anoxia is frequently present. Burning paint and other substances add additional toxic elements. These gases must be distinguished from the so-called poisonous gases of warfare. Many are highly poisonous, though they are incidental to the explosion of missiles. The effect, however, is as serious as the regular chemical warfare agents such as mustard or chlorine.

As medical officers are aware, the ordinary gas mask intended for the regular chemical warfare agents is of relatively little value in protecting against these explosion gases, as it does not compensate for the anoxia which is usually present. The regular rescue breathing mask and apparatus which supplies oxygen to the individual while excluding the poisonous smoke and toxic combustion gases is necessary. Medical officers and others giving instructions in first aid, and in rescue work of this type, should especially emphasize this difference.

THE ONE HUNDREDTH ANNIVERSARY OF THE FOUNDING OF THE BUREAU OF MEDICINE AND SURGERY

August 31, 1942 is the centenary of the founding of the Bureau of Medicine and Surgery. Aside from all other reasons, certain interest surrounds any human institution which has existed for 100 years. And for this reason a portion of the original act which created the Bureau of Medicine and Surgery, together with four other Bureaus of the Navy Department, and of which certain

portions particularly pertain to the Bureau of Medicine and Surgery, is quoted herewith:

Chap. CCLXXXVI.—*An act to reorganize the Navy Department of the United States.* (a)

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the act approved February seventh, eighteen hundred and fifteen, entitled "An act to alter and amend the several acts establishing a Navy Department, by adding thereto a Board of Commissioners," be, and the same is hereby repealed.

SEC. 2. *And be it further enacted*, That there shall be attached to the Navy Department the following bureaus, to wit:
1. A bureau of Navy Yards and Docks.
2. A bureau of Construction, Equipment, and Repairs.
3. A bureau of Provisions and Clothing.
4. A bureau of Ordnance and Hydrography.
5. A bureau of Medicine and Surgery.

SEC. 3. *And be it further enacted*, That the President of the United States, by and with the advice and consent of the Senate, shall appoint, from the captains in the naval service, a chief for each of the bureaus of Navy Yards and Docks, and of Ordnance and Hydrography, who shall each receive a salary of three thousand five hundred dollars per annum, in lieu of all other compensation whatever, in the naval service; and shall, in like manner, appoint a chief of the bureau of Construction, Equipment, and Repairs, who shall be a skilful naval constructor, and shall also appoint a chief of the bureau of Provisions and Clothing, who shall each receive for his services three thousand dollars per annum; and shall in like manner appoint from the surgeons of the navy a chief of the bureau of Medicine and Surgery, who shall receive for his services two thousand five hundred dollars per annum. * * *

For the bureau of Medicine and Surgery, two clerks, one of whom shall receive for his services twelve hundred dollars per annum, and the other shall receive for his services eight hundred dollars per annum; and one assistant surgeon, who shall receive for his services not less than the highest pay of his grade in the service.

SEC. 5. *And be it further enacted*, That The Secretary of the Navy shall assign and distribute among the said bureaus such of the duties of the Navy Department, as he shall judge to be expedient and proper; and all the duties of the said bureaus shall be performed under the authority of the Secretary of the Navy, and their orders shall be considered as emanating from him, and shall have full force and effect as such. * * *

The general duties of the Bureau of Medicine and Surgery may be defined in a single sentence as "the conservation of the health of the Navy," and the many multitudinous tasks in the many diversified fields are directed toward this general purpose. The Medical Department of the Navy has been devoted now to this task for 100 years. Three major wars, the Civil War, World War No. 1, and World War No. 2 are included in that period. In addition to this, what may be called lesser conflicts, the Mexican War and Spanish-American War, must also be included; other numerous minor military

episodes must not be forgotten. In periods of peace, officers and men of the Navy have received medical attention on ships on every sea and in stations beyond the seas.

The centenary of the Bureau occurs in the midst of the greatest war in history, and there is no time for celebrations; but it is a time when we may remember the long period of unremitting work of the Bureau of Medicine and Surgery for the health and comfort of the officers and men of the Navy.

The contrast between the work of the Bureau at a time when two clerks at $1,200 and $800 a year constituted the total civilian force and at present reflect the difference in the size of the Navy in 1842 and 1942 and the different conditions of life then and now. The period covers the time from a wooden and largely sailing ship navy to not only the iron, but the steel ship, the flying ship, and the submarine.

The names of the Chiefs of the Bureau from 1842 to the present date follow:

Barton, W. P. C.	1842–1844	Browne, J. Mills	1888–1893
Harris, Thomas	1844–1853	Tryon, J. Rufus	1893–1897
Whelan, William	1853–1865	Bates, Newton L.	1897–1897
Horwitz, P. J.	1865–1869	Van Reypen, W. K.	1897–1902
Wood, Wm. Maxwell	1869–1871	Rixey, Presley M.	1902–1910
Foltz, J. M	1871–1872	Stokes, Charles F.	1910–1914
Palmer, James C.	1872–1873	Braisted, William C.	1914–1920
Beale, Joseph	1873–1877	Stitt, E. R.	1920–1928
Grier, William	1877–1878	Riggs, C. E.	1928–1933
Taylor, J. Winthrop	1878–1879	Rossiter, P. S.	1933–1938
Wales, P. S.	1879–1884	McIntire, Ross T.	1938–
Gunnell, F. M.	1884–1888		

DENTISTRY IN ENGLAND IN WARTIME

The number of dentists in England is gradually diminishing, and that the shortage will become acute in a few years is pointed out in an editorial in the British Medical Journal for April 1942.

In 1939, just before England's entry into the war, there were 15,000 names on the Dentists Register, approximately one dentist for every 2,700 people, or one dentist for every 1,000 population below 25 years of age. (The proportion of dentists to population is more than double this figure in the United States.) The average number of graduates and licentiates annually entering the profession during the last 10 years was 317, and on the basis of the mortality tables, if this figure is continued it means the maintenance of a Register of only just over 12,000. But the position is still worse when it is remembered that in a few years' time there will be a big decline in the number of the "1921" group, even the younger of whom will be approaching the retiring age of the middle or late sixties, and, of course, there will be no replenishment of that group.

The Dental Education Advisory Council of the dental schools of Great Britain has prepared a memorandum suggesting a procedure by which this serious shortage of dentists may be overcome. The memorandum compares the attractions of dentistry with those of other professions. It points out that the high cost of training and the amount of capital required to buy or establish a practice in England means that dentists can be recruited only from a limited class. The editorial continues:

The professions of medicine and law are open to the same class, and the higher social status conferred and financial advantages obtained outweigh the attractions of dentistry as a career. As student entries affect the Register 5 years ahead, the seriousness of the problem should be realized now. The Advisory Council suggests that more students should be attracted by raising the social status of the dental profession (it does not suggest how this is to be done) and by making the financial returns of the senior posts more comparable to those in medicine and law. This, however, cannot be made effective soon enough to prevent a disastrous fall in the number of dentists, and therefore a second line of policy should be adopted fairly quickly—namely, the lowering of dental school fees and the provision of specific scholarships in dentistry (the number of scholarships at present is negligible). This would make dentistry a possible choice to a wider section of the community.

CONTRAST BETWEEN ANESTHESIA IN CIVIL AND MILITARY SURGERY

The method of giving anesthetics has made rapid strides. No longer does the anesthetist in a large hospital use a simple gas and ether machine with a simple dial, but a complicated mechanism with many gadgets, each one designed as a safety factor in aiding the anesthetist to give a safe anesthetic. There are various colored tanks signifying the various gases; there is carbon dioxide for resuscitation, safety mercury controlled pressure regulators, mixture tanks, etc. At his fingertips, are the latest respiratory and cardiac stimulants. On call are trained mechanics to make rapid and immediate repairs, consultants for consultations. The anesthetist is an expert and his duties are only to give anesthetics.

Contrast this same anesthetist if he suddenly found himself in action in a battle dressing station or in a field hospital. He would not find himself in selected surroundings and in an air conditioned room. He would not find himself working with the latest gas machines, but probably with a simple apparatus or an ether can and mask. His cases would not be elective, but emergencies, the injuries severe, perhaps involving the face and respiratory passages complicating the anesthetic, or other parts of the body increasing the risk of the patient. He would find himself inevitably overworked, and the cases would seem to be endless. He would have to be a mechanic and able to repair the smallest part of this apparatus and to improvise a change in technic when necessary. He would be expected to do other duties as well and to do good work with the simple tools supplied. Further-

more, there is not space for complicated machines and in the field with expeditionary forces only readily transported items are of any value. Large and heavy apparatus is worse than useless—is a positive encumbrance.

It is for these reasons that naval surgeons have found that simple things that go back to the beginning of anesthesia, such as a mask and a bottle of chloroform or ether, are the necessities in the front line, and the naval surgeon may be said to be always in the front line. It is surprising how much testing there is to the truth of this reversion to the basic anesthetic in war surgery, ether and chloroform—and particularly the latter, which in military surgery has again and again demonstrated its advantages even over ether. It requires only a small amount of chloroform for anesthesia, a matter of moments where transportation is difficult; is less inflammable than ether, a thing of major importance in a modern naval action; produces anesthesia rapidly, requires less time when a large number of cases have to be operated quickly, and is easily given.

Local anesthesia, so common and so useful in civil surgery, has, of course, its place in war surgery but it again is impractical in the face of most war conditions. The old general anesthetics, ether and chloroform, go back to 1845 and are still, after nearly 100 years, the anesthetic keys of war surgery.

INSIGNIA OF NAVAL FLIGHT SURGEONS

The Chief of Naval Personnel on May 18th approved the following insignia, to be worn on the left breast of officers of the medical corps who are qualified Naval Flight Surgeons. The order is quoted below:

A gold plated metal pin, winged, with slightly convex oval crest, with appropriate embossed rounded edge and scroll. The central device to be surcharged with gold oak leaf and silver acorn, symbol of Medical Corps insignia. The metal pin shall be of dull finish. Dimensions: 2¾ inches between wing tips, central device 1 inch in vertical dimension to lower edge of fringe. Lateral width of oval crest, ¾ inch. Oak leaf ⅞ inch in length, %₆ inch in width, to be vertically mounted surcharged on oval. Silver acorn ⅜ inch in length surmounted on oak leaf.

In the long history of medicine there are many symbols which have been connected with the profession. Two, however, which have been most commonly associated with medicine are the oak leaf and acorn, and the caduceus. The oak leaf and acorn was the insignia of the Druids, the physician-priests of the ancient Britons. Their temples were in the oak groves, and the oak was regarded as a sacred tree. The priests themselves wore white robes with the oak leaf and acorn design embroidered on the sleeve in gold.

The early Greek physicians were a combination of priests and physicians also, and ministered to the spiritual as well as the physical infirmities of people, much as does the medical missionary. These physician-priests were also the teachers of their profession as was the case, too, with the Druids. The great Greek sanitaria, such as that at Cos, the home of Hippocrates, might be described as a combination of hospital, church, and school. The caduceus was the symbol of the Greek physician-priest. It is today the official insigne of the Medical Corps of the Army and of the pharmacists and commissioned officers of the Hospital Corps of the Navy. The Medical Corps of the Navy has worn since 1832, almost without change, the oak leaf and acorn, the other most frequently used symbol of medicine; and a slightly modified form is the insigne of the Dental Corps of the Navy. It is, therefore, strikingly appropriate that the central device of the flight surgeon's wings should carry the gold oak leaf and the silver acorn.

PHYSIOLOGICAL ADAPTATIONS OF PERMANENT DWELLERS AT HIGH ALTITUDES

People who live permanently at great altitudes have made a definite physical adaptation to their environment. This has been definitely stated by Prof. Carlos Monge of the University of San Marcos, Lima, Peru, in a recent symposium of the American Association for the Advancement of Science, held at the University of Chicago. He pointed out that the lowlanders going into a high country can be acclimated after an initial period but that those who have lived permanently at great altitudes have distress when visiting the lowlands. Each year large numbers of Andean men migrate to the lowlands of the coast to work, but they never stay. They have just as much difficulty becoming acclimated to the thick air of the lowlands as the lowlander has becoming used to the thin air of the highlands.

Both the Andean native and the lowlander transplanted there have certain physical similarities. In both, the blood is thicker than in those living at sea level. The blood corpuscles are larger and more numerous, and the fluid is more viscid. Most noticeable, however, are

the chemical changes in the blood, particularly in relation to carbon dioxide exchange.

The highlander has several physical characteristics that the low-lander does not possess. His heart, in proportion to his body, is larger. His lungs have larger air capacity, and their capillaries bring the blood more efficiently into contact with air. The pulse is slower and even after severe exertion causes little change in rate. These are the characteristics that cause distress when the highlander visits the low-lands and are, apparently, of a permanent character. In other words, a distinct physiological type has been developed by the population of the high Andes and, possibly, by the mountain dweller in all parts of the world.

In this connection it has recently been pointed out by cavalrymen that, in the training of mountain troops, it is necessary to condition horses and mules to altitude and it is customary to keep them in the mountains for some time to condition them for mountain service.

NAVAL DENTAL OFFICERS WHO ARE MEMBERS OF THE INTERNATIONAL ASSOCIATION OF DENTAL RESEARCH

The following Dental Officers of the Navy are members of the Inter-national Association of Dental Research:

Captain H. E. Harvey, (Dental Corps) United States Navy.

Lieutenant Commander R. W. Taylor, (Dental Corps) United States Navy.

Lieutenant Commander R. A. Lowry, (Dental Corps) United States Navy.

Lieutenant Commander C. A. Schlack, (Dental Corps) United States Navy.

Lieutenant J. S. Restarski, (Dental Corps) United States Navy.

NEW EDITION OF THE MEDICAL COMPEND FOR COMMANDERS OF NAVAL VESSELS TO WHICH NO MEMBER OF THE MEDICAL CORPS OF THE UNITED STATES NAVY IS ATTACHED

The first edition of the Compend was soon exhausted and with the second printing, certain revisions were made which will be of interest to all medical officers.

In the first place, the poison table is indicated in the new edition by a notched thumb disk, marked in red. All chapters begin on new odd pages. Three illustrations showing resuscitation and artificial respi-ration procedures have been added, as well as instructions regarding the use of sulfonamide in the first-aid treatment of wounds and the addition of these substances to the Medicine Box. A folding chart on warfare gases is another important addition. The cover and general form of the book are unchanged.

THE ANNUAL MEETING OF THE ASSOCIATION OF MILITARY SURGEONS

This year the Association of Military Surgeons of the United States holds its annual meeting at San Antonio, Tex., November 5–7, 1942. The meeting is of more than usual interest in time of war, as the mission of the Association is to stimulate interest in all fields of military medicine and to maintain contacts between military medical men of the armed services of our own and allied countries. This year a large number of official representatives from the Latin-American countries are expected to be present, the location of the meeting place being particularly suitable for visitors from those countries.

Of particular interest to the Medical Corps of the Navy is the fact that the incoming president of the Association is a naval medical officer, Capt. W. L. Mann, who will take office at this meeting.

The Association is, perhaps, next to the American Medical Association, the largest medical society in the United States. Its international contacts through military surgeons of other countries, the great importance of military medicine at present, and the fact that the Association is a quasi official organization, its original charter having been granted by Congress, make it an important group in wartime.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,
UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington, D. C.

(For review)

MINOR SURGERY, by *Charles M. Oman, M. D., F. A. C. S., Rear Admiral, Medical Corps, U. S. Navy; Commanding Officer, National Naval Medical Center, Bethesda, Maryland.* 165 pages. Oxford University Press, New York, publishers, 1942. Price $2.

In order to review a medical book correctly, the reviewer should know something about the experience and background of the author so that the value of the book can be better judged before recommending it to the reader. In this instance, the reviewer knows the author personally and that he is a nationally outstanding surgeon, has for years been on the National Board of Medical Examiners, and a member of the Board of Governors of the American College of Surgeons. Therefore, Admiral Oman's experience makes him an authority in the field of surgery.

The author has, in his book, kept in mind the necessity of staying within the limits of minor surgery, and has not included any procedure that cannot be used in an outpatient clinic or doctor's office. He also makes the point plain that minor surgery may become major surgery at any time and furthermore that fine surgical judgment is as important in the minor as in the major field.

The book is presented in a concise outline form (as are all the Oxford series) so that each subject is covered completely in two or three pages. Between each new page is a blank sheet that can be used for notes.

Among the newest treatments, the author deals with the use of sulfonamides in the various injuries and infections. He also includes the use of blood plasma and blood substitutes for the treatment of shock, and lists and gives the technic of the various methods of administration.

1003

The book contains 16 chapters. Its small size and light weight makes it a most handy reference work, particularly in the field with expeditionary forces, and similar situations, where the military surgeon needs a compact reference work. For the student, interne, and young surgeon also this book should prove ideal.

THE AMERICAN TEXTBOOK OF PROSTHETIC DENTISTRY, In Contributions by Eminent Authorities, edited by *L. Pierce Anthony, D. D. S., Editor of the Journal of the American Dental Association.* Seventh edition, thoroughly revised; 926 pages, illustrated with 842 engravings and 3 color plates. Lea & Febiger, publishers, 1942. Price $11.

A review of this book reveals repetition of some phases of prosthetic dentistry which have remained basic and consequently bear emphasis. Several chapters are included which are relatively new in subject matter treated. These are: Chapter IX, "Acrylic Resins"; Chapter X, "Artificial Denture Plastics Other Than Vulcanite"; and Chapter XVII, "Educating Denture Patients" which includes the subject of diet and its influence on tissue reactions under prosthetic appliances.

The book is well written, particularly well edited, amply and clearly illustrated and as usual Lea & Febiger have published the material with a high degree of technical skill.

THEORY AND PRACTICE OF CROWN AND BRIDGE PROSTHESIS, *by Stanley D. Tylman, A. B., D. D. S., M. S., F. A. C. D., Professor of Prosthetics, Head of the Department of Fixed Partial Dentures, University of Illinois, College of Dentistry, Chicago, Ill.* 815 pages with 1,000 text illustrations and 9 color plates. The C. V. Mosby Co., St. Louis, Mo., publishers, 1940. Price $10.

The dental profession has for a long time been in need of a modern textbook in crown and bridge prosthesis. This book meets this need and is a welcome addition to the dental library.

The subject matter is presented in a clear and concise manner and is illustrated with numerous photographs and diagrammatic drawings. These illustrations help to clarify certain step-by-step procedures in technic and add greatly to the value of the book. It is clearly printed and attractively bound.

This book is highly recommended not only as a text for the student but also as a reference book for the practitioner.

PRACTICAL ANESTHESIA FOR DENTAL AND ORAL SURGERY, Local and General, by *Harry M. Seldin, D. D. S., F. I. C. D., F. I. C. A., Consulting Oral Surgeon, Harlem Hospital, New York City Cancer Institute, and at Peekskill Hospital, Peekskill, N. Y.* Second edition, 560 pages, illustrated with 217 engravings. Lea & Febiger, Philadelphia, Pa., publishers, 1942. Price $7.

This book adequately covers the field of anesthesia and its application in dental operations. The first section of this publication is devoted to the subject of local anesthesia. The author's descriptions of the various injections used in the practice of dentistry are most

comprehensive. If the student and practitioner will give this section careful consideration, they should encounter little difficulty in becoming proficient in the most recent technics. Very fine illustrations in the form of schematic drawings, photographs and charts, are incorporated in this edition.

The second part of this textbook discusses general anesthetics employed in dental surgery. A detailed report, including methods of administering, advantages and disadvantages of numerous general anesthetics is nicely presented. The subject of resuscitation as outlined by the author should aid materially in dispelling the fears experienced by some operators when giving a general anesthetic.

This book is highly recommended as a guide for improvement of technic and for presenting a clearer conception of the reaction of anesthetics on the human system.

PHARMACOLOGY AND DENTAL THERAPEUTICS, A Textbook for Students and Practitioners by *Hermann Printz, A. M., D. D. S., M. D., Sc. D., Dr. Med. Dent.*, and *U. Garfield Rickert, A. M., D. D. S.* Eighth edition, thoroughly revised by Edward C. Dobbs, D. D. S., Associate Professor of Pharmacology, Baltimore College of Dental Surgery, Dental School, University of Maryland. 507 pages, illustrated. The C. V. Mosby Co., St. Louis, Mo., publishers, 1941. Price $6.50.

By virtue of the seven previous editions, this well-known book has demonstrated its usefulness in serving the dual function of being a splendid text for the dental student as well as an authoritative reference for the practitioner.

This, the eighth edition, is revised by E. C. Dobbs, who has brought the book up to date by deleting the obsolete drugs and including the more recent pharmaceutical preparations. As a basis, for the selection of his material, the author has chiefly considered those drugs and preparations listed in the eleventh decennial edition of the United States Pharmacopoeia, the sixth edition of the National Formulary, New and Nonofficial Remedies for 1940, and the sixth edition of Accepted Dental Remedies.

Throughout the book, succinct expression of the text matter, as in former editions, is maintained. Should the reader desire more detailed data, these may be easily obtained by the use of the list of references.

This book is composed of 15 chapters, 44 illustrations, covers 507 pages, and is printed in standard type.

The present revision should continue to fulfill the same useful purpose as it has served in the past.

OXFORD MEDICAL OUTLINE SERIES, published by Oxford University Press, New York, 1941. Price $2. each.

These Oxford Medical Outline Series are becoming so well known to the medical profession that to call the 1941 series to the attention of the practicing physician is sufficient.

As usual, the publishers had each volume written by an outstanding man in his field, and each author incorporated all the vital fundamentals of each subject treated. Each book is up-to-date in its information, condensed, and written in outline form. Between each new page is a blank sheet that can be used to make permanent notes. The following books comprise the 1941 issue:

Subject	*Author*
Minor Surgery	Charles M. Oman, M. D., F. A. C. S.
Abdominal Surgery	John E. Hammett, M. D., F. A. C. S.
Thoracic Surgery	Charles W. Lester, A. B., M. D., F. A. C. S.
Visual Outline of Psychiatry	Leland E. Hinsie, M. D.
Diseases of the Respiratory Tract	Jacob Segal, M. D., F. A. C. P., F. A. C. C. P. Harry Wessler, M. D.
Surgery of Head and Neck	Arthur S. McQuillan, A. B., M. D., F. A. C. S.
Neuro-Anatomy	Walter R. Spofford, B. S., Ph. D.
Histology and Embryology	Jose F. Nonidez, Sc. D.
Obstetrics	Hervey Clock Williamson, M. D., F. A. C. S. George Schaefer, M. D.
Fractures and Dislocations	Kenneth M. Lewis, B. S., M. D., F. A. C. S.

THE ELECTROCARDIOGRAM AND X-RAY CONFIGURATION OF THE HEART, by *Arthur M. Master, B. S., M. D., F. A. C. P., Cardiologist to the Mt. Sinai Hospital, New York; Assistant Professor of Clinical Medicine, Columbia University, New York.* Second edition, enlarged and thoroughly revised. 404 pages with 163 illustrations. Lea & Febiger, Philadelphia, Pa., publishers, 1942. Price $7.50.

This edition is a complete x-ray monograph of the heart in addition to being a compendium on the relationship between the electrocardiogram and the cardiac configuration.

Electrocardiography is considered more comprehensively in this edition and emphasis is again placed on those phases of heart disease which lend themselves to roentgenological diagnosis. There is a new grouping of material, and new cases and sections have been added. Some of the tracings of chest leads are indeed interesting. This book will find favor with cardiologists, but is probably too advanced for basic students of electrocardiography as a part of the picture of general medicine.

The teleoroentgenograms and electrocardiograms are nicely reproduced.

UROLOGY IN WAR, Wounds and Other Emergencies of the Genito-Urinary Organs, Surgical and Medical, by *Charles Y. Bidgood, Lieutenant Commander, Medical Corps, United States Naval Reserve.* 78 pages, illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1942. Price $2.

This book has been written for the naval medical officer in the field, aboard ship, or in isolated outposts where a specialist in urology is not available, and where the doctor, who is not a specialist, will be faced with the responsibility of caring for these cases.

The book contains only 78 pages including the index. This is an attractive feature as only the essential points in the various treatments are given. There are a number of excellent illustrations and the print and type of paper make it easily read.

ROENTGEN TREATMENT OF INFECTIONS, by *James F. Kelly, M. D., F. A. C. R., Professor and Director of the Department of Radiology, Creighton University School of Medicine;* and *D. Arnold Dowell, M. D., Assistant Professor of Radiology, Creighton University School of Medicine.* 432 pages, illustrated. The Year Book Publishers, Inc., publishers, 1942. Price $6.

The volume is written in a concise manner and is well illustrated by charts, tables, and reproductions.

The section on gas bacillus infection should be of inestimable value to surgeons generally and to the military surgeon in particular. It provides him with a simple, practical modality in the prophylaxis and treatment of gas bacillus infections resulting from compound fractures, penetrating wounds, etc., that will not only reduce the mortality in these infections tremendously, but will save many a limb.

The claims of the good results obtained in peritonitis, pneumonias, mastoiditis by roentgen therapy as compared with other established methods of treatment, is open to debate.

In the treatment of the other infections described by the authors, nothing new has been added, and they have merely confirmed the good results reported by others.

THE PRINCIPLES OF NEUROLOGICAL SURGERY, by *Loyal Davis, M. S., M. D., Ph. D., D. Sc., (Hon.), Professor of Surgery and Chairman of the Division of Surgery, Northwestern University Medical School, Chicago, Illinois.* Second edition, 503 pages, illustrated with 154 engravings, containing 298 illustrations and 5 color plates. Lea & Febiger, Philadelphia, Pa., publishers, 1942. Price $7.

The author states that the purpose of his book is to give to the medical student and practitioner easily assimilable facts which will aid them in getting a more accurate concept of neurological surgery so that their patients will receive accurate and sound advice. He did not include detailed instructions on neurosurgical technic, nor did he attempt to make the book an encyclopedia. The book is well written, and the material is presented in a straightforward way without too many complex neurological terms, so that the student and practitioner can easily understand the various subjects.

This book is the second edition and has been enlarged and thoroughly revised. The size of the type and the nonglossy paper makes it easy reading. This book is recommended for the student and medical practitioner.

SYNOPSIS OF MATERIA MEDICA, TOXICOLOGY, AND PHARMACOLOGY, For Students and Practitioners of Medicine, by *Forrest Ramon Davison, B. A., M. Sc., Ph. D., M. B.,* Medical Department, *The Upjohn Co., Kalamazoo, Mich.* Second edition, 695 pages, with 45 illustrations. The C. V. Mosby Co., St. Louis, Mo., publishers, 1942. Price $5.75.

One of the features of this excellent little book is a compend of prescription writing, short and simple and yet for its size astonishingly complete. It is followed by another excellent section on toxicology, including a list of contents for a poison antidote case needed by every general practitioner. The pharmacologic action of the various drugs is very well given. Vitamins, hormones, serums and vaccines are all included, as well as the sulfonamides, coumarin, gramicidin, and the use of blood plasma, indicating that the book is as up to date as it is possible to make it.

HUGHES' PRACTICE OF MEDICINE, revised and edited by *Burgess Gordon, M. D., Clinical Professor of Medicine, Jefferson Medical College, and contributors.* 16th edition, 791 pages with 36 illustrations. The Blakiston Co., Philadelphia, Pa., publishers, 1942. Price $5.75.

When a book has gone through 16 editions it proves that it has had a real demand, and this is the case with Hughes' Practice of Medicine. It was originally designed by Dr. Hughes to fill a place between the small compend and the voluminous volume on practice. Dr. Gordon has apparently kept this in mind in his revision. In order to keep the book within this limit it has been necessary to use good judgment in allotting the various portions of space to different diseases and good judgment has been shown in this regard. Long discussions, of course, have been left out and the essentials of diagnosis and treatment make a prominent feature. An interesting section is the treatment of the effects of the poisons of modern war gases, a subject not found in the ordinary volume on the practice of medicine. The sulfonamide compounds are presented and there is a section on mental diseases with a good glossary. There is also a section on geriatrics, an increasingly important subject; and a very fine brief compend on skin diseases.

NURSING CARE OF COMMUNICABLE DISEASES, Prophylactic Technics for the Prevention and Control of Disease, by *Mary Elizabeth Pillsbury, R. N., M. A., Adviser in Hospital, School and Communicable Disease Nursing Administration.* Sixth edition, revised, 585 pages, 137 illustrations and 8 charts. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1942. Price $3.

This is an outstanding book on communicable diseases covering thoroughly that phase of nursing.

The book starts out with the principles used in the prevention and control of diseases, including terminology, definition, community infection, and the value of the application of the principles of medical aseptic technic in the prevention of the spread of disease to and from the patient in the hospital and home.

Next the disease, definition, history, occurrence, medical aspect, measures of disease control, and nursing care are presented clearly by the author in a most interesting manner.

Illustrations are numerous, complete, and clear. The glossary and index are quite adequate. This book may serve as a combination text and reference not only for the graduate nurse, but the student as well.

MANAGEMENT OF THE SICK INFANT AND CHILD, by *Langley Porter, B. S., M. D., M. R. C. S. (Eng.), L. R. C. P. (Lond.),* and *William E. Carter, M. D.* 977 pages, illustrated. Sixth revised edition. The C. V. Mosby Co., St. Louis, Mo., publishers, 1942. Price $11.50.

This is the sixth edition of this book which in itself speaks for its popularity. The authors have again, as they have in the last five editions, revised and sifted out the outmoded material and introduced the newest information on the management and care of the sick infant and child.

The first few chapters of the book stress the importance of handling vomiting, diarrhea, constipation, and nutrition. The chapter on nutrition is particularly of interest to those not specializing in pediatrics, as it explains clearly the problems met in infant nutrition and gives a simple method for calculating a formula.

The last few chapters deal with the systemic as well as the infectious diseases. There is a long chapter on the various methods of intravenous and spinal therapy and the usual methods of gavage, and rectal feeding. Many practical points in laboratory technic are also given. The last chapter contains a poison chart and treatment.

All through the book the important points that the authors want stressed are put in large boldface type. The book is well indexed and the table of contents is very complete. There are 96 illustrations and 3 charts. This is a good book for both the specialist and general practitioner.

TEXTBOOK OF CLINICAL PARASITOLOGY, Including Laboratory Identification and Technic, by *David L. Belding, M. D., Professor of Bacteriology and Experimental Pathology, Boston University School of Medicine.* 890 pages with 1,356 illustrations. D. Appleton-Century Co., Inc., New York, publishers, 1942. Price $8.50.

Dr. Belding offers this work as "a textbook of medical parasitology for medical students, physicians, medical personnel in the armed services, public health officials, laboratory workers and biologists." He notes that it differs from the traditional textbook "in the extensive use of tables and graphic representations that facilitate study and access to information, in the presentation of the immunity of parasitic infections, and in the inclusion of a special section on technical methods for laboratory workers."

It is a large book and in general contains the same information as other textbooks on this subject. The material is well classified and the descriptions of the parasites and their life cycles well done. There are over forty tables in which much information is tabulated. Some of these seem to be just what many students may be looking for in attempts to integrate their knowledge, others are less informing and, I believe, quite useless, e. g., table 10 and others similarly arranged in which a discouraging pattern of black dots confronts the eyes.

The illustrations are well selected and well reproduced. There are many schematic drawings to illustrate morphology and life cycles and these are generally very good. In some the author seems to have gone to the extreme in simplicity and sacrificed interesting and important details. *Endolimax nana* and *Iodamoeba bütschlii* in figures 21 and 22 have been given a rather fanciful nuclear structure which is likely to confuse rather than assist the student. However, on the whole the text of this book is better elucidated by various kinds of illustrations than other works on clinical parasitology.

The section on technical methods for the diagnosis of parasitic infections is very complete and useful.

A MANUAL OF ROENTGEN DIAGNOSIS, by *Kenneth S. Davis, M. S., M. D., Professor of Radiology, College of Medical Evangelists, Clinical Professor of Medicine (in Radiology), University of Southern California School of Medicine, Radiologist to St. Vincent's Hospital, Los Angeles.* Privately printed by Cossitt & Co., Inc., San Francisco, Calif. 160 pages, illustrated. Price $3.50.

This book has been based on the experience of the author while a professor of radiology at the College of Medical Evangelists, and has been primarily written for medical students.

The Manual is very instructive as the first few chapters are devoted to the dangers of x-rays, the protection of the operator, preparation of the patient, normal bones, the various centers of ossification, etc. Following, the author gives the types of fractures, bone infections, and the different bone diseases. The last few chapters deal with the body systems and stresses the diagnosis of x-rays of the gastro-intestinal tract, the gall bladder, and urinary tract.

This Manual is well illustrated with actual photographs as well as drawings. The type is easily read. This Manual would prove of value to the practicing physician who takes his own x-ray films as well as the medical student.

THE EYE MANIFESTATIONS OF INTERNAL DISEASES, by *I. S. Tassman, M. D., Associate Professor of Ophthalmology, Graduate School of Medicine, University of Pennsylvania, Philadelphia.* 542 pages with 201 illustrations, including 19 in color. The C. V. Mosby Co., St. Louis, Mo., publishers, 1942. Price $9.50.

Somewhere there is an adage that reads, "Read a man's eye and you read his character." Little did the author of this saying realize that

years later one could almost say, "Look in a man's eye and you can diagnose his physical condition."

For a long time the reviewer, while teaching, has stressed the importance of the examination of the eye in systemic diseases, and has pointed out the necessity of learning the characteristics of the normal eye as well as the pathological. The author of this book has organized his material in a similar manner, by devoting the first few chapters to the normal structure of the eye and orbit, the general causes of eye manifestations, and also examination of the patient. After these introductory chapters, he discusses the various congenital and hereditary manifestations, and infections and infectious diseases. The last few chapters discuss the eye conditions in the various blood and systemic diseases, avitaminosis and nutrition, tumors, diseases of the skin and drug and chemical intoxications.

The book is well indexed and contains also a detailed table of contents. At the end of each chapter are numerous references. There are many colored plates as well as photographs. The colored plates of the eye grounds are exceptionally well produced.

This is an unusually good book, and is recommended to the medical student, the intern, the surgeon, and the practitioner.

PROFESSIONAL ADJUSTMENTS IN NURSING, For Senior Students and Graduates, by *Eugenia Kennedy Spalding, R. N., M. A.* Second edition, revised and reset. 566 pages with 30 illustrations. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1941. Price $3.

A superior, up-to-date presentation of social, economic, and political developments, and their relationship to satisfactory professional adjustments.

This book, with its excellent bibliographies and suggested references, should be of immeasurable guiding value to every nurse.

DISEASES OF THE SKIN, by *Frank Crozer Knowles, M. D., Professor of Dermatology; Edward F. Corson, M. D., Clinical Professor of Dermatology; and Henry B. Decker, M. D., Assistant Professor of Dermatology, Jefferson Medical College.* 621 pages with 272 illustrations. Fourth edition, thoroughly revised. Lea & Febiger, Philadelphia, Pa., publishers, 1942. Price $7.

This new edition is a complete revision of the old text. The authors have revised the entire book, sorted and discarded the old material and substituted the latest information on the diagnosis and treatment of skin diseases.

The first chapter contains a section covering the anatomy and physiology of the skin. Each disease is then followed by the usual definition, symptoms, etiology, diagnosis, treatment, and progress. The sulfonamides and vitamins have been stressed and each given their proper place among the therapeutic measures. Of interest to the Navy are some of the more important tropical skin diseases which

have been described.   A new feature is a workable plan for the treatment of syphilis.

Twenty-one new engravings have been added and 28 of the older illustrations have been substituted for new ones.   The print is large, and a fine grade of paper is used.   The book is well indexed and each disease described contains adequate references.

SURGICAL PHYSIOLOGY, by *Joseph Nash, M. D., F. A. C. S., Assistant Professor of Clinical Surgery, New York University College of Medicine.*   482 pages, 16 figures.   Charles C. Thomas, Springfield, Ill., publishers, 1942.   Price $6.

The author has developed this book on the basis of lectures given since 1930 as part of the graduate course in surgery at New York University College of Medicine.   He has given the basic physiological processes involved in the practice of surgery.

The reviewer believes that a surgeon who hasn't the correct understanding of the physiologic action of the various organs and systems of the body, cannot possibly achieve good results from his surgery. The author's book fills this need for those who wish to get the latest information on human physiology.

The book is divided into seven sections.   Section I, The Circulatory System; Section II, The Respiratory System; Section III, The Alimentary System; Section IV, Body Fluids; Section V, the Endocrine Glands; Section VI, the Cerebrospinal Nervous System; and Section VII, The Autonomic Nervous System.

Of the seven sections, Section IV, Body Fluids, would probably be of more interest at this time to doctors in the Navy, as it contains the latest information on the body fluids, water balance, salt balance, etc., which is so important in the treatment of burns.

There is an excellent bibliography and the work is well indexed. The print is large and easily read.   A good book for the surgeon and internist.

THE FUNDAMENTALS OF INTERNAL MEDICINE, by *Wallace M. Yater, M. D.*   First edition, revised.   1021 pages, illustrated.   D. Appleton-Century Co., New York, publishers, 1941.   Price $9.

The author states in the preface, "In general, an attempt has been made to present the minimum amount of knowledge of clinical medicine a medical student or general practitioner should have at his fingertips."   A practitioner who has the knowledge contained in this volume will be indeed well grounded in his profession.   Throughout it is apparent that a successful effort has been made to stress the important features without neglecting the rarer ones, and to give clear descriptions without the use of unnecessary words.

The sections on diagnosis are unusually good.   The many illustrations are clear and well chosen.   In addition to the usual subjects in a book on "Medicine" there are brief but adequate sections on skin

diseases, diseases of the ear and eye, and dietetics. An unusual number of typographical errors mar an exceptionally good book.

SIMPLIFIED NURSING, by *Florence Dakin, R. N., Former Inspector of Schools of Nursing, State of New Jersey, Graduate of the New York Hospital;* and *Ella M. Thompson, R. N., B. S., Assistant Director Practical Nurse Training, Ballard School, Young Women's Christian Association of the City of New York.* 444 pages with 70 illustrations. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1941. Price $2.

This book, due to its marked simplicity, and general health and housekeeping information is invaluable to the practical nurse and layman.

The illustrations are complete and distinct enough to cover the fundamental nursing methods and technics.

PEDIATRIC GYNECOLOGY, by *Goodrich C. Schauffler, A.B., M.D., Assistant Clinical Professor of Obstetrics and Gynecology, University of Oregon Medical School.* 384 pages, illustrated. The Year Book Publishers, Inc., Chicago, Ill., publishers, 1942. Price $5.

The author discusses the pediatric gynecology cases frequently seen in every pediatric, gynecologic, general medicine and surgical, urologic and proctologic practice. Previous to this book very little has appeared in literature describing these pediatric conditions, so that Dr. Schauffler's book is a pioneer in this field.

He discusses fully specific diagnostic and therapeutic procedures, and points out little practical "pointers" all through the book. The author's literary style is excellent and thus his book is interesting reading.

The book contains 384 pages and 66 illustrations. The type of print is large and the book easily read. This is an excellent guide for those who come in contact with pediatric gynecological conditions.

LANE MEDICAL LECTURES: THE LYMPHATIC SYSTEM, Its Part in Regulating Composition and Volume of Tissue Fluid, by *Cecil K. Drinker, Professor of Physiology and Dean of the School of Public Health, Harvard University.* 101 pages, illustrated. Stanford University Press, Stanford University, Calif., publishers, 1942. Price $2.25.

This book contains the twenty-eighth series of lectures sponsored by Dr. Levi Cooper Lane of San Francisco, the founder of Cooper Medical College, which in 1908, became the School of Medicine of the Leland Stanford University. The first series of lectures were given in 1896, and, continuing the policy of having eminent speakers, the School of Medicine chose Dr. Cecil Drinker as the speaker for 1941.

Dr. Drinker divided his lectures into five parts: 1. Physiological principles displayed in the evolution of the mammalian circulation; 2. Establishment and characteristics of the capillary circulation; 3.

Appearance and elaboration of lymphatic vessels; 4. Blood, tissue fluid, and lymph as illustrated by experiments upon the heart and lungs; 5. Relations of the lymphatic system to practical problems in surgery and medicine.

As the author compares the evolution of the mammalian type of lymph circulation to that of the human, he draws attention to the points of historical interest, and illustrates his lecture with extraordinary drawings.

The author has not only contributed the latest information on lymph and its circulation, but he correlates his findings by making practical application to them in the last chapter where he deals with the practical problems in surgery and medicine.

This book should be of value to the embryologist, anatomist, physiologist, clinician and surgeon. Not only is it of value as a reference or textbook, but its classical and literary style places it high among medical textbooks, and makes it a "must" for the connoisseurs of good books.

FOOTE'S STATE BOARD QUESTIONS AND ANSWERS FOR NURSES, by an *Editorial Panel of 11 authorities in nursing education.* Twentieth edition, 1104 pages, J. B. Lippincott Co., Philadelphia, Pa., publishers, 1942. Price $3.50.

This book, specially designed for nurses studying for state board examinations, is an excellent guide for a quick and thorough review.

The revised edition has undergone marked changes in reflecting the advances made in nursing art and science. It includes a new arrangement of material, as well as a careful reexamination and revision of questions and answers. Each subject presented in the basic nursing course is fully and adequately covered. All sections are brought up to date.

This is not only a reliable treatise for the student preparing for state board examination, but a valuable reference for the graduate nurse who wishes to keep abreast of the current advances in nursing.

THE ART AND SCIENCE OF NUTRITION, A Textbook on the Theory and Application of Nutrition, by *Estelle E. Hawley, Ph.D.* and *Grace Carden, B.S., The University of Rochester, School of Medicine and Dentistry, Rochester, N. Y.* 619 pages with 140 illustrations including 12 in color. The C. V. Mosby Co., St. Louis, Mo., publishers, 1941. Price $3.50.

The book as a whole is a well written textbook and it is apparent that the authors tried to bring the bibliography and nutritional advances up to date. It has a few welcome innovations such as "Nutritional Habits of Different Nationalities" and a vade mecum of nutrition at the end of the book. Chapter XVI on roughage and the venture into treatment of diseases such as the authors tried in treating constipation with agar-agar and mineral oil is regarded as not in accord with medical teaching and not without danger to a lay reader if followed literally.

THE DIVISION OF PREVENTIVE MEDICINE

Captain C. S. Stephenson, Medical Corps, United States Navy, in charge

TOXIC EFFECTS OF ARSENICAL COMPOUNDS

AS ADMINISTERED IN THE UNITED STATES NAVY IN 1941 WITH SPECIAL REFERENCE TO ARSENICAL DERMATITIS

By Captain C. S. Stephenson, Medical Corps, United States Navy, Chief Pharmacist's Mate, W. M. Chambers, United States Navy, and Mrs. Laura T. Anderson, Junior Administrative Assistant, Bureau of Medicine and Surgery

For the past 17 years medical officers of the Navy have been required to submit to the Bureau of Medicine and Surgery monthly reports of the number of doses of arsenicals administered and the reactions therefrom. This information has been compiled and published in the following United States NAVAL MEDICAL BULLETINS:

September 1925	April 1933	October 1936	October 1939
January 1927	October 1933	January 1937	January 1940
January 1929	October 1934	October 1937	October 1940
July 1930	January 1935	January 1938	January 1941
October 1931	October 1935	October 1938	October 1941
October 1932	January 1936	January 1939	January 1942

In table 1 is shown the number of doses of each arsenical administered in the year 1941, the reported reactions which occurred, and similar data for the 17-year period 1925–41. It is noted that in 1941 there was 1 reaction to 4,805 doses and 1 death to 105,703 doses. For the 17-year period 1925–41 there was 1 reaction to 1,603 doses and 1 death to 34,469 doses.

TABLE 1.—*Arsenicals, U. S. Navy, 1941 and 1925–41—type of drug, reaction, and ratio of doses to reactions*

	Number of doses adminis- tered	Reactions				Ratio of reactions to doses 1 to —	Ratio of deaths to doses 1 to —
		Mild	Severe	Fatal	Total		
Year 1941:							
Bismarsen	186	0	0	0	0	0	0
Mapharsen	85,485	11	2	[1] 1	14	6,106	105,703
Neoarsphenamine	16,169	4	4	0	8	2,021	0
Sulfarsphenamine	544	0	0	0	0	0	0
Tryparsamide	3,319	0	0	0	0	0	0
Total	105,703	15	6	1	22	4,805	105,703
17-year period 1925–41:							
Acetarsone [2]	971	1	0	0	1	971	0
Arsphenamine	41,558	27	14	1	42	989	41,558
Bismarsen [3]	3,691	0	0	0	0	0	0
Mapharsen [4]	288,585	35	14	[1] 1	50	5,772	288,585
Neoarsphenamine	1,355,058	630	315	50	995	1,362	27,101
Silver arsphenamine [5]	586	0	1	0	1	586	0
Sulfarsphenamine	30,834	17	8	0	25	1,233	0
Tryparsamide	71,100	3	1	0	4	17,775	0
Total	1,792,383	713	353	52	1,118	1,603	34,469

[1] A cerebral hemorrhage following the administration of mapharsen.
[2] First administered during the year 1932.
[3] First administered during the year 1929.
[4] First administered during the year 1935.
[5] First administered during the year 1931.

TABLE 2.—*Proportion of reactions of various types, 1929-41*

Classification	Number of reactions	Percent of total reactions	Classification	Number of reactions	Percent of total reactions
Vasomotor phenomena...	353	40.07	Arsenical neuritis.........	2	0.23
Arsenical dermatitis......	336	38.14	Acute renal damage......	2	.23
Blood dyscrasias..........	44	4.99	Border line, hemorrhagic encephalitis...........	1	.11
Liver damage............	40	4.54			
Table reactions..........	26	2.95	Liver damage (doubtful reaction)...............	1	.11
Jarisch-Herxheimer.......	23	2.61			
Reactions of minor importance.................	22	2.50	Vascular damage (probable adrenal hemorrhage)..................	1	.11
Gastrointestinal..........	18	2.04			
Hemorrhagic encephalitis.	9	1.02			
Optic neuritis............	3	.34	Total...............	881	100.00

ARSENICAL DERMATITIS

Dermatitis in some form was observed in 10, or 45 percent of the total reactions in 1941, as compared with 55 percent for 1940. The type of lesion was erythematous in three instances, exfoliative in three, macular in one, maculopapular in one, morbilliform in one, and scarlatiniform in one. The reactions were classified as six mild, and four severe.

MILD REACTIONS

The six mild reactions occurred after the following number of injections: Two after the third injection, and four after the fourth.

The interval between the injection and appearance of symptoms varied from 30 minutes to 2 days. The length of time required for complete recovery varied from 1 to 7 days.

NEOARSPHENAMINE

Case 1-1941.—This patient had no syphilitic infection, but was being treated with an arsenical compound for Vincent's angina.

Arsenical treatment began with a 0.3 gram injection of neoarsphenamine on October 29, 1941, followed by 0.45 gram injections on November 3 and 4, and a 0.6 gram injection on November 5.

Six hours after the last injection the patient experienced nausea for about 6 to 7 hours and hard, shaking chills. These symptoms were repeated the next day and, in addition, a generalized macular rash, more severe about the hips was noted. Temperature, 100° F. The CBC was within normal limits. No specific treatment was given. Recovery in 7 days.

Case 2-1941.—This patient developed two small papules on coronal sulcus of the penis and a slight swelling of the inguinal glands following exposure to infection of June 26, 1941. Darkfield examinations were positive for *Treponema pallidum.*

Arsenical treatment began with a 0.3 gram injection of neoarsphenamine on July 10, 1941. A 0.6 gram injection was given on July 15, and 6 hours later the patient complained of chilliness and headache. Temperature, 100.6° F., pulse 108. Examination revealed flushed face and a red and inflamed throat. Four days later a scarlet rash appeared on the head and throat and spread to the chest.

On July 22 the patient was given a 0.45 gram injection of neoarsphenamine, and 30 minutes later he complained of headache and a general tingling feeling of the skin. He later became nauseated and had bile stained emesis. Four hours after the injection the temperature was 102° F. At that time 1 gram of sodium thiosulphate was given intravenously. Marked improvement was noted and the patient recovered in 2 days.

MAPHARSEN

Case 3-1941.—One month after exposure to infection on March 24, 1941, this patient developed a penile lesion which was positive for *Treponema pallidum*.

Arsenical treatment began with a 0.03 gram injection of mapharsen on March 27, 1941, followed by 0.06 gram injections on April 3 and 10. The patient experienced a slight reaction after the first injection and no reaction following the second injection. The patient became dizzy immediately after the third injection and 8 hours later developed a mild chill, nausea and a fine rash on the body and legs. There was no vomiting or diarrhea. The patient felt better the next day and the erythematous rash was less marked. Temperature, 99.6° F. All symptoms cleared rapidly, and the patient was returned to duty in 2 days.

Case 4-1941.—An initial chancre developed 1 month after exposure to infection on December 27, 1940. Several darkfield examinations were negative. Because of persistence of the lesion, a provocative injection of mapharsen was given on February 8, 1941. Slight fever and accentuation of the initial lesion resulted. A Kahn blood test on February 8 was 4-plus.

Arsenical treatment began with a 0.03 gram injection of mapharsen on February 7, 1941, followed by 0.06 gram injections on February 15, 22, and March 1. Three injections of bismuth subsalicylate were given as concurrent treatment.

Two days after the last injection of mapharsen the patient experienced a mild reaction to the drug, characterized by maculo-papules distributed generally over the extremities, the trunk, the genito-crural area, gluteal area, and on the chest. These maculo-papules were small, variously sized, discrete to confluent, and itched intensely, at times becoming blood crusted from scratching. Temperature, 99.8° F.; pulse, 80; and respiration, 18. The RBC and WBC were within normal limits.

The patient was given bed rest and light diet for the first 6 days. Sodium thiosulphate was given intravenously, once daily for 5 days. The temperature became normal on the fourth day. Lesions disappeared on March 10, and the patient developed a fine body rash similar to pityriasis rosea.

Case 5-1941.—This patient was given a diagnosis of syphilis on October 15, 1941, because of repeated positive Kahn blood tests.

Arsenical treatment began with a 0.045 gram injection of mapharsen on October 17, 1941, followed by a 0.06 gram injection on October 20, and a 0.04 gram injection on November 5. Eighteen hours after the last injection the patient was regarded as completely recovered 7 days after onset of symptoms.

Treatment consisted of forced fluids and a mild laxative. The rash faded completely within 48 hours from onset. Antiluetic treatment was continued with small doses of tryparsamide.

Case 6-1941.—This patient was exposed to infection on October 1, 1941, and 1 month later a Kahn blood test was 4-plus.

Arsenical treatment began with a 0.03 gram injection of mapharsen on November 4, 1941, followed by 0.06 gram injections on November 11, 18, and 25, a total of 0.21 gram.

Two hours after the last injection the symptoms of dizziness, weakness, nausea, and general erythema were noted. Temperature, 101.5°F.

Two 1-gram injections of sodium thiosulphate were given 4 hours apart. Recovery occurred in 24 hours.

SEVERE REACTIONS

The four severe reactions occurred after the following number of injections: One each after the second, seventh, eighth, and thirteenth. The interval between the injection and appearance of symptoms varied from 2 hours to 2 days. The length of time required for recovery varied from 6 to 34 days.

NEOARSPHENAMINE

Case 7-1941.—A primary lesion on the penis developed following exposure to infection on September 27, 1941. A darkfield examination was positive for *Treponema pallidum.* A Kahn blood test was 4-plus.

Arsenical treatment began with a 0.3 gram injection of neoarsphenamine on November 8, followed by 0.6 gram injections on November 10, 13, 17, 20, 24, and 28.

Six hours after the last injection the patient complained of general malaise, became nauseated and vomited several times. Within 24 hours an erythematous, papulo-urticarial pruritic eruption appeared and slowly intensified during the succeeding 4 days. An icterus was apparent within 48 hours. This increased in severity and persisted for about 18 days. Pain and tenderness in the right upper abdominal quadrant and in both lumbar areas appeared early and lasted about one week. The icterus index was 47 units on December 1. On December 16 the W. B. C. was 23,350; R. B. C., 4,700,000; hgb., 94 percent; segs., 23; lymphs, 39; monos, 7; eosins, 31. Blood chemistry: NPN 28 mg. per 1,000 cc.; chlorides, 462 per 1,000 cc.; sugar, 68 mg. per 1,000 cc.; urea nitrogen, 11 mg. per 1,000 cc.

From December 2 to 12 the patient was given six 1,000 cc. injections and two 2,000 cc. injections of 10 percent glucose in normal saline intravenously. Sodium phosphate 1 dram in water was given t. i. d. each day. From December 16 to 20, propadrine hydrochloride 3/8 grain was given orally every 4 hours. Edema of the arms, legs, and face appeared on the 14th day and lasted for about 5 days. Exfoliation began on the 19th day and was complete 10 days later.

Palliative local treatment was instituted, beginning with zinc oxide lotion and changing to Lassar's paste during the exfoliative stage of the dermatitis. Edema, rash, and subjective symptoms disappeared on December 28. Slight exfoliation persisted until December 30. Recovery occurred in 32 days.

Case 8-1941.—This patient, exposed to infection on May 15, 1941, was admitted to the sick list on July 5 with "fungus infection" at which time a lesion on shaft of the penis was noted. The fungus infection responded to treatment, but the penile lesion persisted. Kahn blood tests were positive, and a darkfield examination was positive for *Treponema pallidum*

Arsenical treatment began with a 0.45 gram injection of neoarsphenamine on July 17, and a 0.3 gram injection on July 22. Two injections of bismuth subsalicylate were given as concurrent treatment. One hour and 45 minutes

after the first injection on July 17 the patient complained of general malaise, headache, a feeling of numbness, and chills. The temperature was 104° F., but dropped to normal within 4 hours. Slight headache persisted the next day.

After the second injection on July 22, the patient again complained of general malaise, headache, feeling of numbness, and severe pains in the lumbar and sacral regions. Temperature, 103° F.

July 23: Morning temperature, 99.4° F. Symptoms returned during the afternoon with an elevation of temperature to 105° F.

July 25: Throat edematous and red about both tonsils and pillars, with some swelling of submaxillary glands. Temperature, 105° F.; pulse 100.

July 26: Face and body covered with morbilliform rash. No pruritus. Little epistaxis. General condition markedly improved.

July 27: Temperature 102° F., general condition markedly improved. No complaints of pain or discomfort. Patient remains almost completely covered with rash. Hands and feet not involved.

Treatment consisted of sodium thiosulphate intravenously, 1,000 cc. of 10 percent dextrose in saline intravenously, Armour's bone marrow concentrate by mouth, and pentnucleotide intramuscularly.

The patient was improved after the appearance of the rash, and recovered completely after its disappearance. Recovery in 15 days.

Case 9, 1941.—This patient was exposed to infection in July 1940. An examination on September 20 revealed a secondary rash over the chest, back, arms, and legs, generalized lymphadenopathy, and enlarged epitrochlears. Two Kahn blood tests were 4-plus.

The first course of arsenical treatment started on September 20 and consisted of 8 injections of mapharsen, a total of 0.45 gram. Twelve injections of bismuth subsalicylate were given as concurrent treatment.

The second course of arsenical treatment began with a 0.03 gram injection of mapharsen on January 7, 1941, followed by 0.06 gram injections on January 14, 22, 29, and February 4.

Two days after the last injection the patient noticed a mild exfoliative dermatitis of the upper extremeties, extendings to the biceps region. Injections were stopped and the dermatitis faded.

On February 12 dermatitis on both legs and swelling of the feet were noted. There was a marked exfoliation of anterior surface of the left leg and mild exfoliation of the right leg and dorsal surfaces of both hands. R. B. C., 4,200,-000; hgb, 85 percent; W. B. C., 11,500; bands, 3; segs, 65; lymphs, 27; monos, 3; eosins, 1; basos, 1. Wet dressings of potassium permanganate were applied for 9 days, followed by cod liver oil dressings. Recovery occurred in 34 days.

Case 10–1941.—This patient was given a diagnosis of syphilis in 1930 because of a positive darkfield examination.

From April 8 to May 21, 1930, he received 7 injections of neoarsphenamine. A severe exfoliative dermatitis followed the seventh injection. (Reaction described in the April, 1931 NAVAL MEDICAL BULLETIN, page 233).

Antisyphilitic therapy was continued by intermittent treatment with bismuth. Kahn blood tests were negative after March 13, 1931, except for a reported 2-plus on January 9, 1937. On April 29, 1941, the patient reported with a small, healing, penile lesion, which he stated had been present for from 2 to 3 weeks. A Kahn blood test was negative on April 30.

A 0.03 gram injection of mapharsen was administered on May 5, 1941. In the next 24 hours he had several chills, a fever ranging from 100°F. to 103°F., and an irregular, macular skin rash. A Kahn blood test was 4-plus. During

the following week the skin lesions caused severe pruritus, and developed into an exfoliative dermatitis. The patient was returned to duty 6 days from onset of symptoms.

SUMMARY

In 1941, medical officers of the Navy administered 105,703 doses of arsenicals and reported the occurrence of 22 reactions therefrom. Of these reactions 10 were arsenical dermatitis; a ratio of one case of dermatitis to 10,570 doses. Of interest in connection with the etiology of arsenical dermatitis is the number of instances in which premonitory signs were noted. These signs are repeated below and serve to indicate the necessity for careful examination and questioning of each patient before administering an arsenical.

Case 2.—A scarlatiniform rash developed after the second injection of neoarsphenamine. Thirty minutes after the third injection, given one week later, the patient developed a headache and tingling feeling of the skin, and later became nauseated and had bile stained emesis.

Case 3.—A slight reaction occurred after the first injection of mapharsen. An erythematous rash with chills and nausea followed the third injection given 2 weeks later.

Case 8.—After the first injection of neoarsphenamine the patient developed general malaise, headache, feeling of numbness, and a temperature of 104° F. The same symptoms accompanied by a morbilliform rash developed after the second injection given 1 week later.

Case 10.—A severe exfoliative dermatitis developed after the seventh injection of neoarsphenamine given on May 21, 1930. Another severe exfoliative dermatitis developed following the first injection of mapharsen given 11 years later.

COMMON NEUROTROPIC VIRUS DISEASES OF MAN [1]

THEIR DIAGNOSIS AND MODE OF SPREAD

By Ex-Lieutenant Joseph E. Smadel,[2] Medical Corps, United States Naval Reserve

Clinical and pathological manifestations of the epidemic infectious diseases of man produced by neurotropic viruses are so alike that it is impossible to establish the identity of individual illnesses in this group without resort to laboratory procedures. The similarity of the diseases caused by different neurotropic viruses may extend to entire epidemics, for example, outbreaks caused by the viruses of St. Louis and Japanese encephalitis present the same general characteristics (1) (2) (3) (4) (5). In certain instances, however, the consideration of a number of epidemiological factors may enable differentiation of one group of cases from another; thus, epidemics of encephalitis lethargica (6) (von Economo's encephalitis), Western equine encephalitis (7) (8), and poliomyelitis (9) might readily be recognized as dissimilar entities if they should occur in separate outbreaks.

GENERAL CHARACTERISTICS OF EPIDEMICS CAUSED BY NEUROTROPIC VIRUSES

The clinical and epidemiological data which are of particular assistance in classifying a group of cases of infectious encephalitis include those dealing with the severity of neurological involvement, the frequency and type of neurological residuals, the mortality, the time of the year when the epidemic occurs, and the group of the population which is most often affected.

TABLE 1.—*Infectious encephalitis*

Fever
Nausea and vomiting
Headache
Stupor or hyperexcitability
Neck rigidity
Abnormal deep and cutaneous reflexes
Eye signs: pupillary changes
        strabismus
        nystagmus
        diplopia
Speech disturbance
Tremors
Paresis and paresthesis
Spinal fluid changes: increased pressure
        increased protein
        increased cells
Neurological and psychological residuals

It is unnecessary to discuss at length the signs and symptoms of acute encephalitis; the classical findings are enumerated in table 1. Needless to say, all of these abnormalities are rarely seen in one patient. The clinical data most helpful for the characterization of an epidemic are those concerned with oculomotor palsies, neurological residuals, and with the number of cells in the spinal fluid. Both eye signs and residuals are common in encephalitis lethargica (10) and in Eastern equine encephalitis (11). The spinal fluid contains 100 to 200 cells per cm., principally lymphocytes, in most of the encephalitides, but in Eastern equine encephalitis (11) (12) and in choriomeningitis (13) the cell counts reach 1000.

The mortality rate in the various epidemics goes hand in hand with the clinical severity of the disease. The death rate has been consistently high in encephalitis lethargica; in this country the annual figure has rarely been below 50 percent, and over the years has averaged nearly 70 percent (3). The mortality rate in the comparatively small epidemic of Eastern equine encephalitis in New England was about 60 percent (11) (12) while in the recent large epidemic of Western equine encephalitis it was only about 5 percent (8). Since the death rate in St. Louis and Japanese encephalitis varies directly

with the age of the patients, the average rates for all cases in epidemics of these types of infectious encephalitis are less consequential than the rate for a given decade (3). Thus, while the mortality rate for the entire group of cases in St. Louis in 1933 was 22 percent, the rate for patients in the first decade of life was only 6 percent whereas in the 9th decade it was 85 percent. Japanese encephalitis has presented a somewhat similar increase in mortality rate in older patients but here the figure for each of the first five decades of life is about 50 percent, the subsequent progressive increase in each decade bringing the average for the entire group to 65 percent. The number of proved cases of lymphocytic choriomeningitis is still under 100 and the number of deaths in this selected group is small (14).

The pathological lesions in the several types of infectious encephalitis are monotonously similar (1) (11) (15). Lymphocytic infiltrations in the meninges and choroid plexus, cuffs of mononuclear cells about vessels deep in the brain substance, glial nodules, and nerve cell degeneration are all present frequently. However, the intensity of the lesions varies somewhat in different virus infections, as does the degree of involvement of the spinal cord. In general, the pathological picture is more closely correlated with the severity of the clinical neurological manifestations than it is with the type of infectious agent.

Certain virus infections affect particular groups of the general population, therefore information regarding the age, sex, and occupation of the majority of the cases in an epidemic is of importance. Different types of distribution according to age are exemplified by encephalitis lethargica, poliomyelitis, and St. Louis encephalitis. In the first, all age groups are equally affected (6); in the second, the majority of cases occur in the first decade of life (9) and progressively decrease thereafter, while in the last disease the morbidity and mortality progressively increase with each decade (1) (2). In two types of infectious encephalitis, i. e., Russian (16) and Western equine encephalitis (8), men are affected much more frequently than are women. This distribution does not indicate a greater susceptibility of the male but, instead, results from more frequent exposure to the virus of these persons in their daily occupations. For example, forest workers are attacked by ticks which carry the Russian virus; farmers in the fields are bitten by the mosquitoes which are thought to carry the Western equine virus.

The seasonal occurrence of epidemics is another factor of major importance in differentiating certain types of infections. Only lethargic encephalitis has occurred in epidemic form during the winter months (6) and only Russian encephalitis has appeared in the late spring and early summer (16). The other types of disease, i. e.,

St. Louis (1), Japanese (4) (5), Eastern and Western equine enceph-
alitis (12) (8), and poliomyelitis (9) have characteristically occurred
during the summer. The outstanding features of the epidemics
caused by most of the members of the group of neurotropic viruses
under discussion are summarized in table 2.

TABLE 2.—*Clinical Characteristics of Neurotropic Virus Diseases*

Disease	Characteristics
St. Louis encephalitis, 1933.....	1. Epidemic in later summer. 2. Morbidity and mortality increase progressively with each decade of life. Average 22 percent. 3. Spinal fluid cell count, average 150. 4. Neurological residuals, uncommon and mild.
Japanese encephalitis, 1935.....	1. Epidemic in late summer. 2. Morbidity and mortality increase with age. Average 65 percent. 3. Spinal fluid cell count, average 100. 4. Neurological residuals, infrequent.
Russian encephalitis, 1937......	1. Epidemic in late spring and early summer. 2. Adult males (forest workers) affected principally, mortality 30 percent. 3. Spinal fluid cell count, 25–100. 4. Paralysis of muscles of neck and shoulder girdle frequent with residual atrophy in 20 percent of cases.
Eastern equine encephalitis, 1938	1. Epidemic in late summer. 2. Children affected principally; mortality 60 percent. 3. Eye signs common. 4. Spinal fluid cell count, average 1,000. Many polymorphonuclears early. 5. Neurological residuals, frequent and severe.
Western equine encephalitis, 1938–41	1. Epidemic in late summer. 2. Adult males affected principally; mortality 5 percent. 3. Spinal fluid cell count, average 130. 4. Neurological residuals, infrequent and mild.
Lymphocytic choriomeningitis, 1934	1. Protean manifestations of disease. (a) Aseptic meningitis (spinal fluid cell count, 1,000). (b) Meningo-encephalomyelitis. (c) Influenza-like without neurological manifestations. (d) Acute leukemialike.

DIAGNOSIS OF NEUROTROPIC VIRUS INFECTION

It may be emphasized again that in order to establish the nature
of the specific virus responsible for either epidemic disease or the
illness of a single patient, laboratory procedures must be employed.
The two classical methods used for this purpose are, first, isolation
and identification of the virus; and, second, demonstration of the
development of neutralizing antibody in the sera of convalescents.
Since both methods are highly technical, requiring special facilities
and training, simpler laboratory technics have been sought. The
complement-fixation reaction has proved useful in a number of the
neurotropic virus infections for the demonstration of antibodies in
the sera of recovered individuals, and for the rapid identification of
an agent isolated from a patient. These complement-fixation tests
do not supplant the classical procedures but supplement them and
reduce the labor of virus research.

. Howitt (17) demonstrated that the complement-fixation reaction
could be employed with experimental material from Eastern, Western,
and St. Louis encephalitis, and from lymphocytic choriomeningitis.
Diagnostic methods suitable for detecting complement-fixing anti-

bodies in the sera of patients recovering from choriomeningitis were developed by two groups of workers (18) (19) and the results were satisfactorily correlated with those obtained in isolation experiments and neutralization tests. Furthermore, the demonstration of the soluble antigen of choriomeningitis in the spleens of animals inoculated with human material has provided a simple and rapid means of identifying this agent (20). The complement-fixation test applied to convalescent sera has also been successfully used for the diagnosis of human cases of Eastern and Western equine encephalitis, and offers promise for the diagnosis of St. Louis encephalitis (21). The susceptible experimental animals employed in studies on each of the neurotropic viruses are listed in table 3; in addition, the diagnostic procedures used in each infection are mentioned.

TABLE 3.—*Diagnosis of neurotropic virus diseases*

Disease	Susceptible animals	Diagnosis in man				
		Isolation of virus from human tissues			Demonstration of antibodies in convalescence	
		Brain	Blood	Spinal fluid	Neutralizing	Complement-fixing
St. Louis encephalitis	Mice, monkeys, hamsters, horses and suckling rats.	+	−	−	+	+
Japanese encephalitis	Mice, monkeys, sheep, hamsters and wild rodents.	+	+	+	+	-------
Russian encephalitis	Mice, monkeys, sheep, goats and wild rodents.	+	+	+	+	-------
Eastern equine encephalitis	Many mammals and birds	+	− ?	− ?	+	+
Western equine encephalitis	do	+	− ?	− ?	+	+
Lymphocytic choriomeningitis.	Mice, guinea pigs and monkeys	+	+	+	+	+

THE TRANSMISSION OF NEUROTROPIC VIRUS DISEASES

When it is realized that a viral agent was first isolated from epidemic cases of infectious encephalitis in 1933 (1), it is not surprising that only recently has sufficient evidence accumulated to enable one to discuss with some intelligence the epidemiology of neurotropic virus diseases (22). It is principally by the application of knowledge concerning the mode of spread of these agents that we can ultimately hope to prevent the resultant diseases. In the meantime, the administration of prophylactic vaccines to human beings for protection against Russian encephalitis (23) and to horses for protection against Eastern and Western equine encephalitis (24) offers a means of controlling epidemics of these maladies and opens a field for further investigation.

The transmission of lethargic encephalitis and of poliomyelitis will not be discussed in detail in this report. The agent responsible for the former disease has not been isolated and the results of the numerous recent investigations on poliomyelitis are familiar to all physicians.

Suffice it to say that emphasis is no longer placed on the upper respiratory tract as the portal of entry for a droplet-borne agent of poliomyelitis; instead, the gastro-intestinal tract is now thought of as the site of entry for virus borne by water, excreta, or food (25). Ideas regarding the transmission of St. Louis and Japanese encephalitis have also undergone modification recently; both of these diseases were formerly considered to be contracted by way of the upper respiratory passages.

ST. LOUIS ENCEPHALITIS

Careful epidemiological studies made during the 1933 outbreak of encephalitis failed to indicate obvious contagion between patients or to provide evidence of transmission of the disease by way of food, water or milk. The possibility of a mosquito vector for the virus was intensively investigated at that time. *Aëdes aegypti*, *Anopheles quadrimaculatus* and *Culex pipiens* were fed on patients, monkeys, and mice during various stages of the disease; after different intervals of time they were permitted to bite normal human beings and experimental animals. The results were entirely negative (1). It was subsequently demonstrated that *Anopheles quadrimaculatus* can be infected by feeding on mice in which a viremia has been temporarily produced (26). Although these infected mosquitoes were incapable of transmitting the disease to animals by their bite, the virus was detected by inoculating a suspension of the ground insects into the brains of susceptible animals. This observation was not considered highly significant since the virus of St. Louis encephalitis has never been demonstrated in the blood of patients; therefore, it seemed unlikely, on theoretical grounds alone, that mosquitoes could be infected from patients. Furthermore, only occasionally does subcutaneous inoculation of animals with large amounts of virus produce involvement of the central nervous system. On the other hand, intranasal instillation of virus is almost as effective as intracerebral injection (27). In view of the inconclusive evidence concerning the mode of transmission of the virus, it was assumed that the prevalence of neutralizing antibodies in the blood of healthy individuals in St. Louis immediately following the epidemic of 1933— the data indicated the occurrence of subclinical infection in about one third of the population (28)—had resulted from a droplet spread of virus by apparently healthy human carriers.

Recently it has been shown that the sera of healthy and convalescent human beings and horses, as well as the blood of many species of domestic and wild birds and mammals that live in certain epidemic areas, but not elsewhere, possess antibodies which neutralize both the viruses of St. Louis and Western equine encephalitis (7) (29) (30) (31). Although these findings might suggest the presence of a common antigen in the two viruses, this has not been seriously considered

hitherto because of the apparent immunological specificity of the two viruses and of the differences in their host ranges. In view of the demonstrated occurrence of common antigens in Russian and Japanese encephalitis virus (32) and of common factors in Japanese, St. Louis, and West Nile viruses (33), a search should be made for evidence which would correlate Western equine virus with the above agents. This is especially important since evidence has now accumulated which indicates that the host range of St. Louis virus is wider than formerly thought: horses are known to be susceptible (34), a finding which was only suggested by earlier work (1); suckling rats develop fatal encephalitis following intracerebral or intranasal inoculation of virus and, even though obvious disease does not appear in 21-day-old rats following similar inoculations, virus can be recovered from their brains in appreciable amounts (35); and finally, young chicks hatched from infected embryos, or inoculated intracerebrally when 4 to 6 days old, develop clinical and pathological signs of encephalitis, and their brains are infectious (36). Therefore, it is no longer necessary to regard the St. Louis virus as pathogenic only for human beings and a few laboratory animals; however, no natural animal reservoir for the virus has been established by recovery of virus and a search for one is certainly warranted.

Undoubtedly the most important single piece of evidence incriminating the mosquito in the spread of St. Louis encephalitis is the isolation by Hammon and his co-workers (37) of the virus from one of a number of lots of *Culex tarsalis* collected in an epidemic area. This in conjunction with the widespread occurrence of neutralizing antibodies in the sera of man, beast, and bird in affected areas strongly suggests that the mosquito may act as a vector for the virus. To summarize: knowledge of the mode of transmission of St. Louis encephalitis to man remains inconclusive. The isolation of virus from nasopharyngeal washings of patients with active disease has not been successful (38), and this should be possible if spread occurs from apparently healthy human carriers by way of the upper respiratory tract. Finally, the transmission of the disease to man and animals by the bite of infected mosquitoes remains to be accomplished before a mosquito vector can be accepted without reserve.[1]

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[1] Mitamura and his co-workers (39) claim to have infected *Culex pipiens var. pollens* by feeding on virulent mouse brain and then to have transmitted St. Louis encephalitis to mice by the bite of these insects. Positive results were also reported in similar experiments with Japanese virus. In view of the negative results of the American workers (26) with St. Louis virus and of the Russian workers (40) with the Japanese virus these claims must be further substantiated before they can be accepted. It should be noted, however, that *Culex tarsalis* were found to be infected (37) in nature and reports of transmission experiments with infected mosquitoes of this species have not appeared.

JAPANESE ENCEPHALITIS

Even before the isolation of the virus of Japanese encephalitis, Mitamura concluded on the basis of epidemiological studies of previous epidemics that transmission was by way of mosquitoes. Following the isolation of the virus in 1935, Mitamura and his coworkers (39) demonstrated that three varieties of mosquitoes, namely, *Culex tritaeniorhynchus*, *Culex pipiens var. pollens* and *Aëdes togoi* could be infected by feeding on virus laden tissue. These observations have been confirmed and extended by several groups of Russian workers (40) (41). The same investigators also isolated the virus from wild mosquitoes trapped in epidemic areas of the Russian Far East, but not from similar species caught elsewhere. Virus was obtained in six instances from such naturally infected mosquitoes by means of mouse inoculation: once from a lot of *Culex pipiens*, twice from groups of *Culex tritaeniorhynchus* (40), and three times from a collection of 3,000 "*Culex* and *Aëdes*" mosquitos which had been distributed in 24 groups for mouse inoculation (41). Although Petrischeva and Shubladse (40) were unable to transmit the disease to mice by the bite of infected mosquitoes as claimed by Mitamura (39), they nevertheless concluded that the most probable vectors of this type of encephalitis in the maritime district are *Culex tritaeniorhynchus* and *Culex pipiens*.

In general, the evidence for mosquito transmission is more conclusive for Japanese than for St. Louis encephalitis. For example, the virus can be isolated not only from brain tissue (42) of patients but also from their blood and spinal fluid (41). The virus appears in the blood of infected mice (42) and of wild rodents that are susceptible to the virus (43). Finally, mice (and presumably man) are susceptible to subcutaneous injection of the virus (44). Thus, the early opinion of Kawamura (42) that Japanese encephalitis is transmitted by infected droplets originating from healthy carriers is falling into disrepute to be replaced by a theory of mosquito transmission: the final proof for the latter method remains to be presented.

RUSSIAN ENCEPHALITIS

Russian or spring-summer encephalitis has been the most thoroughly and successfully studied disease in the group caused by neurotropic viruses. On the basis of epidemiological evidence it seemed that spring-summer encephalitis in man was not communicated by human contact but that it was probably transmitted by a vector, perhaps one of the blood-sucking arthropods of the forest (16). It was shown that the tick, *Ixodes persulcatus*, occurred regu-

larly in all endemic foci; this tick was known to attack man very actively and to be more numerous than other members of the species in the areas (16). *Ixodes persulcatus* was found to become promptly and strongly infected with the virus when fed on a sick mouse (45). By the sixth day the virus had penetrated all the organs of the tick including the salivary gland; the ticks maintained large amounts of virus in their intestines for at least 25 days (45), and the virus survived in the tick for long periods of time (46) (47). Females of this species, as well as those belonging to the species *Dermacentor silvarum* and *Haemaphysalis concinna*, were able to transmit the disease through the ova to larvae (16) (45) (46), and thence through successive developmental stages (16). Infected adult *I. persulcatus* were capable of transmitting the virus to white mice by feeding (16) (46). It should be noted that the period of feeding must be prolonged to accomplish transmission, *i. e.*, 2 days (46), because no infection occurred when the ticks sucked blood for only a few hours (16).

Since *Ixodidae* ticks were potential vectors of the disease, two groups of workers set out to find whether these arthropods were spontaneously infected in endemic areas. Among 1917 ticks of the *Ixodidae* family which were injected into mice, 28 were found to carry the virus (46); moreover, 28 groups of ticks collected from endemic areas when fed on mice produced encephalitis in 6 instances (46). A similarly large group of ticks, made up of one-half *Ixodes persulcatus*, one-fourth *Dermacentor silvarum*, and one-fourth *Haemaphysalis concinna*, was caught in the spring soon after awakening from hibernation; nine strains of virus were isolated, all from members of the *Ixodidae* family (47). This last observation clearly indicates that the virus can survive throughout the winter in ticks.

Many of the small forest rodents are susceptible to the spring-summer virus (43) and that they do become infected in nature has been indicated by the prevalence of neutralizing antibodies in their sera (48).

Smorodintzev's summary of the epidemiology of the disease may be quoted:

"The circulation of the virus in the encephalitis focus may be conceived in the following way. The larvae and nymphs spontaneously infected with encephalitis infect their principal hosts, the rodents, with a latent or apparent form of encephalitis. It is such rodents that transmit the infection to healthy larvae and nymphs which in their turn communicate the accepted virus to the subsequent stages of development and transovarially. * * * Spring-summer encephalitis is not a primary human disease but affects wild animals. * * * Man * * * does not play any essential role in this normal life cycle" (16).

EASTERN AND WESTERN EQUINE ENCEPHALITIS

The viruses responsible for Eastern and Western equine encephalitis are immunologically distinct (49), furthermore, the Eastern virus is more virulent for both horses and man than is the Western virus (12) (8). Nevertheless, the great similarity of the agents, as shown by, first, their comparable size (50); second, their experimental host range for many birds and animals (51); third, their occurrence in naturally infected wild birds (52) (53) (54) and mammals (54); fourth, the ease with which they are transmitted by various routes of inoculation including the subcutaneous (51); fifth, the fact that several varieties of *Aëdes* mosquitoes may be infected by feeding on animals ill with these diseases and can then transmit the virus by biting (55); and, sixth, the observation that specific formalized vaccines are highly effective prophylactic agents (24); all warrant the discussion of the mode of spread of the two viruses under a single heading.

It is of interest to recall two suggestions offered early in the study of equine encephalitis by the men who isolated the Western and Eastern strains of the virus. Meyer (56) suspected in 1932 that human infection had occurred with the Western strain, and Ten Broeck (57) suggested that birds might serve as a reservoir for the Eastern virus. The importance of human infection with the Western strain is emphasized not only by the repeated outbreaks since 1938 (7) (29) (58) (59) but also by the fact that in the summer of 1941 at least 2,800 cases, with about 150 deaths, occurred in the middle west (7). The occurrence of an avian reservoir has been demonstrated by the finding of Eastern virus in wild pheasants (52) and pigeons (53), and the Western virus in prairie chickens (54). Furthermore, the prevalence of neutralizing antibodies for the Western virus in the sera of many domestic and wild birds (31) indicates the possible extent of this reservoir. The significance of the discovery of Hammon and his co-workers (37) of Western virus in one of a number of lots of *Culex tarsalis* mosquitoes caught in an epidemic area is immediately apparent.

The possibility of the existence of other reservoirs and vectors which contribute to the maintenance and spread of these viruses must be borne in mind. As mentioned earlier, neutralizing antibodies for the Western type are common, not only in birds but also in tame and wild mammals (31). Furthermore, the Western virus has been isolated from a deer (54). Syverton and Berry (60) have shown that the tick, *Dermacentor andersoni*, can become infected by feeding on sick animals and can transmit the disease by biting. Moreover, the infection in ticks is carried through successive stages of development and passed transovarially to succeeding generations. Thus, the pic-

ture is similar to that found in Russian encephalitis, and an analogous means of spread may be postulated for the Western and Russian agents. Naturally infected ticks, particularly hibernating arthropods, have not been found; nevertheless, the suggestion (60) seems reasonable that infection is carried over the winter by ticks which in the spring initiate the disease in mammals; the rapid spread during the subsequent summer might then be effected by mosquitoes and birds.

LYMPHOCYTIC CHORIOMENINGITIS

This neurotropic virus is of particular clinical interest because of the protean manifestations of the disease it produces. It has been shown to be the cause of certain human cases of aseptic meningitis (13) (14) (61), of encephalomyelitis (62), of an influenza-like disease without neurological manifestations (14) (63), and recently, of a fatal disease which simulated acute leukemia in many respects (64). In no instance has the disease been recognized in epidemic form, although epizootics have occurred in mice (65) and monkeys (66), and probably in dogs (67) (68). Nevertheless, infection with this virus apparently is common in human beings, for neutralizing antibodies have been demonstrated in 12 percent of the bloods from approximately 2000 individuals living in institutions throughout the United States, most of whom had no history suggestive of previous infection of the central nervous system (14).

Transmission of the virus *in utero*, or by contact shortly after birth, occurs readily in mice (69). Adult mice from colonies infected with the epizootic disease discharge virus in their urine and nasal secretions (65). Furthermore, virus has been demonstrated in nasal secretions of patients with the disease (62). It has been shown that animals may be infected in a variety of ways other than by the ordinary routes of injection, e. g., by instillation of virus into the nose (69), and by application of virus to lightly scarified skin and perhaps even to normal skin (70). The multiple sources of contamination with the virus and the diverse portals of entry of the agent have provided the basis for a number of explanations of the means of transmission of the disease to human beings and animals.

Armstrong and his co-workers (71) have demonstrated an association between infected house mice and human cases of lymphocytic choriomeningitis and they believe that the mouse serves as a means of infecting man. The possibilities that infection is transmitted to man by inhalation of dust which has been contaminated by infected urine and nasal secretions of mice (14), or by way of direct contact of urine on slight abrasions of the skin (68) have been suggested.

Transmission of infection by biting insects remains a possibility since a systemic disease is readily produced in animals by the in-

tracutaneous inoculation of virus. Coggeshall (66) found that *Aëdes aegypti* mosquitoes were capable of transmitting the disease to normal guinea pigs by biting as early as 4 days and as late as 15 days after feeding on an infected animal. Nymphs of *Dermacentor andersoni stiles*, which were fed during their larval stage on infected guinea pigs, were able to transmit the disease by biting (72). Adult ticks became infected by feeding but were unable to transmit the disease by biting although crushed infected adult ticks or their feces applied to scarified skin resulted in infection (72). Attempts to transmit infection with bed bugs, rats and mouse fleas, blood sucking mites (14), and *Pediculus humanus corporis* (68) have been unsuccessful even though these species contained virus for at least some hours after feeding. The possibility of person to person transmission of the disease, by droplet infection for example, has been considered (68) but there is no epidemiological evidence to support such a hypothesis. It should be pointed out, finally, that normal adult mice and guinea pigs (14) (70) do not readily become infected when caged in contact with sick animals.

In conclusion, while any of a number of modes of transmission of choriomeningitis are theoretically possible, the most likely means would appear to be contamination from excreta of infected house mice either by way of the upper respiratory route or through direct contact with abraded areas of skin. The recent recognition of the susceptibility of dogs to infection together with the fact that they can carry the virus without showing apparent disease (67) (68) (73) suggests that these animals should also be considered in an explanation of the spread of the virus (74).

A summary of the information on the modes of transmission and the natural reservoirs of the viruses discussed in detail in the preceding section is given in table 4.

TABLE 4.—*Spread of neurotropic virus diseases*

Disease	Transmission	Natural reservoir
St. Louis encephalitis	1. Upper respiratory route by droplet infection? 2. Mosquito vector?	1. Human beings? 2. Birds and mammals?
Japanese encephalitis	1. Mosquito vector? 2. Upper respiratory route by droplet infection?	1. Wild rodents? 2. Human beings?
Russian encephalitis	Ticks	Wild rodents and ticks.
Eastern equine encephalitis	Mosquito vector?	Wild birds and mammals.
Western equine encephalitis	1. Mosquito vector 2. Ticks (?)	Birds and mammals.
Lymphocytic choriomeningitis	1. Contact with virus in excreta of infected house mice. 2. Contact with infected dogs?	1. House mice. 2. Dogs?

CONCLUSIONS

The limited type of response displayed by the human central nervous system to infections with most of the neurotropic viruses makes it

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impossible to diagnose on clinical grounds the agent responsible for the illness of a given patient. Even epidemics caused by different viruses may be indistinguishable until adequate laboratory studies have been carried out. Therefore, the general term "infectious encephalitis" should be applied until the specific agent responsible for the disease has been established either by its isolation in animals or by the demonstration of the development of specific antibodies in the patient's serum.

Russian, Eastern and Western equine encephalitis, and choriomeningitis appear to be natural diseases of animals or of birds which affect man only under certain circumstances. St. Louis and Japanese encephalitis may belong in the same general category.

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STATISTICS

HEALTH OF THE NAVY

The statistics (annual rates per 1,000) appearing in this summary were compiled from data contained in monthly reports of communicable diseases received in the Bureau for the months of January, February, and March, 1942.

January, February, March, 1942

ENTIRE NAVY

Year	All diseases	Injuries and poisonings	All causes	Communicable diseases		Venereal diseases
				A	B	
1937	276	36	313	18	98	59
1938	387	46	434	9	128	86
1939	423	47	470	19	168	80
1940	499	49	548	21	206	90
1941	591	45	636	87	254	62
1942	519	47	566	67	223	41

FORCES ASHORE

Year	All diseases	Injuries and poisonings	All causes	Communicable diseases		Venereal diseases
				A	B	
1937	312	36	347	34	131	21
1938	447	50	497	14	195	40
1939	487	47	534	10	253	41
1940	583	43	626	26	300	49
1941	759	46	805	140	370	42
1942	569	46	615	83	251	26

FORCES AFLOAT

Year	All diseases	Injuries and poisonings	All causes	Communicable diseases		Venereal diseases
				A	B	
1937	256	37	293	8	78	78
1938	353	44	397	6	90	113
1939	390	47	437	24	125	100
1940	439	54	493	17	139	119
1941	458	44	502	46	163	78
1942	431	48	478	39	175	67

DISEASES CAUSING SURVEY

The following table was prepared from reports of medical surveys received in the Bureau during January, February, and March, 1942, in which disabilities or disease causing the survey were noted existing

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prior to enlistment. With certain diseases, survey followed enlistment so rapidly that it would seem that many might have been eliminated in the recruiting office:

Cause of survey	Number of surveys	Cause of survey	Number of surveys
Absence, acquired, teeth	49	Curvature, spine	5
Abscess, periapical	1	Cyst	2
Achylia gastrica	1	Cyst, pulmonary	1
Adhesions, intestinal	1	Cyst, teratoma, inflamed	1
Allergy	3	Deafness, bilateral	11
Amblyopia	41	Deafness, unilateral	12
Angioneurotic edema	1	Defective physical development	2
Ankylosis	1	Deformity, acquired	49
Arthritis, chronic	8	Deformity, congenital	24
Asthma	31	Dementia praecox	26
Astigmatism, compound hyperopic	17	Diabetes mellitus	4
		Dislocation, articular cartilage	3
Astigmatism, compound myopic	11	Dislocation, chronic, recurrent	5
		Drug addiction	1
Astigmatism, simple hyperopic	3	Eczema	3
Astigmatism, simple myopic	5	Effort syndrome	5
Astigmatism, mixed	4	Emphysema, pulmonary	1
Atresia, acquired, nasopharynx	1	Encephalitis, chronic	3
Atrophy, leg	1	Endocarditis, chronic	1
Blindness, unilateral	2	Enuresis	46
Bronchiectasis	8	Epilepsy	85
Burn, radium, chest	1	Epiphora	1
Bursitis, chronic	1	Fistula (jejunal-colic)	1
Calculus, kidney	2	Flat foot	51
Cardiac arrhythmia, paroxysmal tachycardia	3	Focal infection, teeth	1
		Foreign body, traumatic	1
Cardiac arrhythmia, premature contractions	1	Fracture, simple	4
		Fungus infection	2
Cardiospasm	1	Genu valgum	1
Caries, teeth	30	Glycosuria	4
Cataract, traumatic	1	Goiter, exophthalmic	1
Cholecystitis, chronic	2	Gonococcus infection, ankle	1
Chorea	2	Gonococcus infection, urethra	2
Chorioretinitis	3	Hallux valgus	3
Cicatrix, skin	5	Headache	4
Cirrhosis, liver, atrophic	1	Heart disease, congenital	6
Colitis, chronic	3	Hemangioma	1
Color blindness	37	Hemiplegia, old	3
Congenital displacement of heart	1	Hemophilia	1
		Hernia, diaphragmatic	1
Constitutional psychopathic inferiority without psychosis	22	Hernia, inguinal, direct	1
		Hernia, inguinal, indirect	17
Constitutional psychopathic state, criminalism	3	Hernia, recurrent after operation	2
Constitutional psychopathic state, emotional instability	42	Hernia, ventral	4
		Hydrocele	1
Constitutional psychopathic state, inadequate personality	30	Hydronephrosis	1
		Hyperopia	3
Constitutional psychopathic state, paranoid personality	5	Hypertension, arterial	36
		Hypertensive heart disease	1
Constitutional psychopathic state, pathological liar	1	Hyperthyroidism	2
		Hypotension, arterial	1
Constitutional psychopathic state, sexual psychopathy	4	Incontinence, urine	2
		Insufficiency, ocular muscle	1
Contracture, hand	1	Intra-cranial injury, (old)	2
Cryptorchidism	1	Irritable colon	3

Cause of survey	Number of surveys	Cause of survey	Number of surveys
Joint, internal derangement of_	2	Raynaud's disease_____	3
Keratitis_____	1	Rhinitis, atrophic_____	5
Loose body in joint_____	1	Rupture, traumatic_____	1
Loss of substance, of bone_____	1	Sclerosis, disseminated_____	2
Lymphogranuloma, venereum__	1	Seasickness_____	5
Malnutrition_____	2	Sexual perversion_____	1
Malocclusion, teeth_____	14	Sinusitis, ethmoidal_____	2
Mental deficiency, moron_____	11	Sinusitis, maxillary_____	4
Metatarsalgia_____	1	Somnambulism_____	7
Migraine_____	3	Spondylitis_____	1
Myocarditis, chronic_____	5	Spondylolisthesis_____	1
Myopia_____	21	Sprain, chronic_____	5
Myositis, chronic_____	11	Spur, bone_____	1
Nephritis, chronic_____	3	Strabismus_____	20
Neuralgia_____	1	Stricture, ureter_____	1
Neuritis_____	5	Stricture, urethra_____	1
Neurosis, gastric_____	3	Syncope_____	3
Neurosis, intestinal_____	3	Synovitis, chronic_____	4
Neurosyphilis, serological_____	1	Syphilis_____	9
Nostalgia_____	1	Syphilis, sero-positive only____	4
Nystagmus_____	1	Tachycardia_____	1
Osteochrondritis dessicans_____	2	Talipes_____	1
Osteoma_____	3	Teratoma_____	2
Osteomyelitis, chronic_____	2	Thrombosis, veins_____	1
Otitis media, chronic_____	141	Tuberculosis, acute, pneumonic, active, far advanced _	2
Pansinusitis_____	2		
Papillitis_____	1	Tuberculosis, pulmonary, chronic, active_____	42
Paradentosis_____	5		
Paralysis agitans_____	1	Tuberculosis, pulmonary chronic, arrested_____	116
Paralysis, muscle_____	2		
Paralysis, nerve_____	4	Tuberculosis, pulmonary, miliary arrested_____	16
Paralysis, ocular muscle_____	3		
Paralysis, palsy, Erb's_____	1	Tuberculosis, pulmonary, primarily healed_____	21
Perforated nasal septum_____	1		
Pes cavus_____	6	Tuberculosis, tracheobronchial, arrested_____	1
Pleurisy, fibrinous, chronic____	9		
Pneumonitis, chronic, nontuberculous_____	2	Ulcer, duodenum_____	32
		Ulcer, stomach_____	3
Polypus, nasal_____	2	Union of fracture, faulty_____	8
Polypus, vocal cords_____	1	Ureteral colic_____	1
Psoriasis_____	1	Urethritis, chronic, (nonvenereal)_____	1
Psychoneurosis, anxiety neurosis_____	8		
		Urticaria_____	1
Psychoneurosis, compulsion neurosis_____	1	Valvular heart disease, aortic insufficiency_____	1
Psychoneurosis, hysteria_____	31		
Psychoneurosis, neurasthenia__	5	Valvular heart disease, aortic and mitral_____	3
Psychoneurosis, psychasthenia_	1		
Psychoneurosis, traumatic_____	4	Valvular heart disease, mitral insufficiency_____	35
Psychoneurosis, unclassified___	3		
Psychoneurosis, with other disability (mental deficiency)___	2	Valvular heart disease, mitral stenosis_____	4
Psychosis, epileptic_____	1	Varicose veins_____	2
Psychosis, manic depressive___	4		
Psychosis, unclassified_____	1	Total_____	1, 564

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